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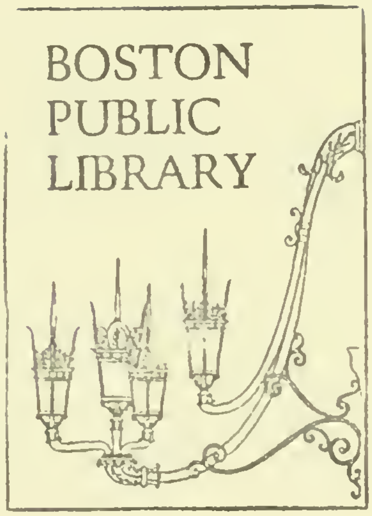

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PARK PLAZA
ENVIRONMENTAL IMPACT REPORT
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SUPPLEMENTAL ANALYSIS

Oct 2 1975

VOLUME II
THE ALTERNATIVES

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Park Plaza
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PART V

PARK PLAZA PROJECT DEVELOPMENT PROGRAM ALTERNATIVES

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PREPARED BY:

THE BOSTON REDEVELOPMENT AUTHORITY

WITH THE ASSISTANCE OF

THE SARATOGA ASSOCIATES

CONTENTS

PART V - PARK PLAZA PROJECT: DEVELOPMENT PROGRAM ALTERNATIVES

- Introduction
  - Criteria for Alternative Development Program Definition And Interpretation
  - DPI Methodology and Process
- DPI Alternatives
- Impact Generators
  - Natural Physical
  - Built Physical
  - Social-Political
  - Economic

PART V - PARK PLAZA DEVELOPMENT PROGRAM ALTERNATIVES

INTRODUCTION

The second major task of environmental impact analysis is to predict probable development actions affecting the environment. By predicting the project actions and "loading" the actions on the Environmental Base, environmental impacts may be discerned and analyzed.

This part of the Building Study Stage Environmental Impact Statement sets forth the methodology and approach to this task, as governed by the criteria indicated below, displays the five alternative development program interpretation (DPI) models and establishes the first order impact generators used in Part VI to test and evaluate the environmental impacts of the proposed Park Plaza project.

CRITERIA FOR ALTERNATIVE DEVELOPMENT PROGRAM DEFINITION AND INTERPRETATION

To be effective instruments for environmental impact analysis, the alternative development program interpretation (DPI) models must be responsive to and reflective of several criteria.

A. The DPI models must be relevant; that is, they must reasonably and reliably approximate the actual intended development of the project area. This criteria inplies conformance to the general urban renewal plan objectives for the Park Plaza in terms of physical and legal policy constraints on development, and in terms of the desirable functional use mix. The alternatives must be capable of attracting the necessary debt and equity financing.

B. The DPI models must be comprehensive; that is, they should reflect a reasonable range of alternative densities of development ranging from "no action" to maximum possible development with intermediate densities between.

The National Environmental Policy Act (NEPA) requires the comparative evaluation of project alternatives. The Commonwealth of Massachusetts, Chapter 30, Sections 61 and 62 of the General Laws follow NEPA's precedent and incorporates similar requirements. In response to this stimulus, the Boston Redevelopment Authority, with the urging of the Civic Advisory Council, identified five alternative development programs ranging in density from two million to six million square feet.

The alternative density levels selected to generate program descriptions of the Park Plaza project are:

- Six Million Square Feet ... this, the uppermost level of density, is the maximum permissible under the approved Urban Renewal Plan. It exceeds the density of all previously considered developers' proposals.
- Five Million Square Feet ... an intermediate density.
- Four Million Square Feet ... approximates the maximum developable density permissible within current zoning restrictions.
- Three Million Square Feet ... an intermediate density.
- Two Million Square Feet ... the lowest end of the range, is included to serve as a base-line reference. In effect, it is a "No Build" option representing the density which might result from "piece-meal" redevelopment of currently vacant land without the impetus of an urban renewal plan and major public improvements.

C. The DPI models must be dynamic - that is, they must reflect the process of development as well as the product and ultimate use. The process components of each alternative DPI model must describe the essential actions involved in the following phases of development:

A - Acquisition of Property
B - Relocation of Existing Residents and Businesses

C - Disposition of Property for Redevelopment

D - Demolition of Existing Structures

E - Excavation and Site Preparation

F - Construction of New Development

G - Occupancy and Use of the Completed Project

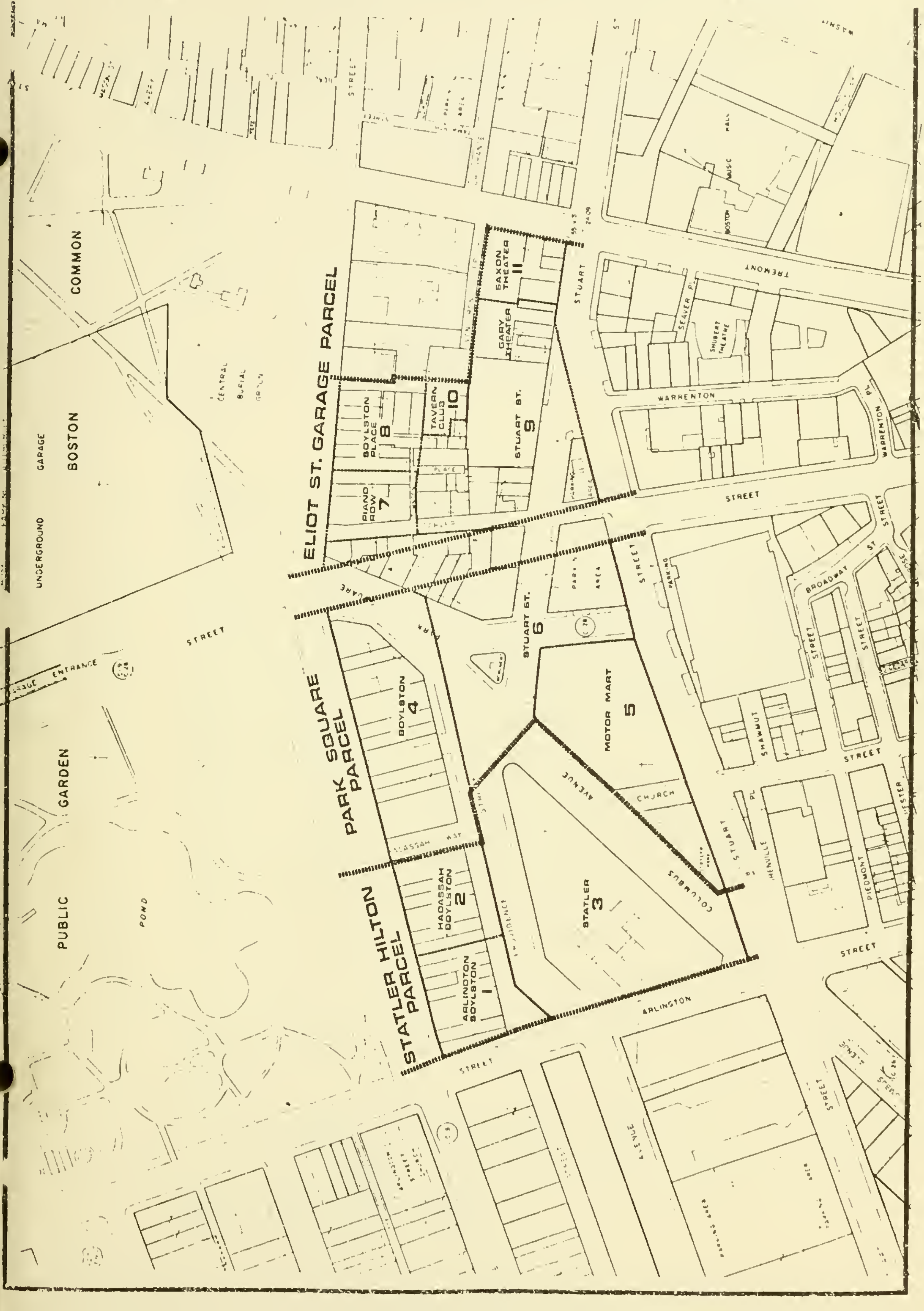
D. The DPI models must be analytically useful; that is, capable of describing the essential developmental actions or activities which will affect the environment. The purpose of the Building Study Stage Environmental Impact Statement is to analyze the environmental impacts of the proposed urban renewal plan, not a specific design solution. Therefore, the concern is with "program-generated" impacts which are essentially established by the density and use mix limitations imposed on the project. Many impacts can be generated by specific designs, and conversely, such impacts can generally be mitigated by design techniques. Thus, specific evaluation of alternative "design-generated" issues - such as the visual or energy impact of various building materials, is not considered relevant to this analysis.

DEVELOPMENT PROGRAM INTERPRETATION (DPI) METHODOLOGY AND PROCESS

The starting point for derivation of DPI Alternatives is the Urban Renewal Plan.

The Urban Renewal Plan serves as the legal foundation for the Development Program and, as such, establishes the parameters within which Alternatives are constructed. Namely, the plan includes:

- Project Boundary Description
- Urban Renewal Plan Objectives
- Proposed Renewal Actions including clearance, redevelopment and public improvement activities
- Property acquisition requirements
- Land use and building requirements including height limitations, allowable floor area ratios, rights-of-way and easements, off-street parking requirements
- Subway terminal connections
- Mixed land use types, specifically including residential, hotel, office, parking, commercial, entertainment, cultural and open space
- Miscellaneous requirements for landscaping, on-site improvements, sign control, utilities and handicapped persons' facilities.


BOSTON COMMON
UNDERGROUND GARAGE
CENTRAL BURIAL GROUND
PUBLIC GARDEN
POND
GARAGE ENTRANCE
ELIOT ST. GARAGE PARCEL
PARK SQUARE PARCEL
STATLER HILTON PARCEL
ARLINGTON BOYLSTON 1
HADASSAH BOYLSTON 2
STATLER 3
BOYLSTON 4
MOTOR MART 5
STUART ST. 6
PIANO ROW 7
BOYLSTON PLACE 8
STUART ST. 9
TAVERN CLUB 10
SAXON THEATER 11
GARY THEATER
SHUBERT THEATRE
BOSTON MUSIC HALL
TREMONT
STUART
WARRENTON
WARRENTON PL
STREET
PARK SQUARE
PARKING AREA
HADASSAH WAY
PROVIDENCE
COLUMBUS AVENUE
CHURCH
SHAWMUT
BROADWAY
PIEDMONT
CHARLES
ARLINGTON
AVENUE
PARKING
SEAVER PL

As the course of the Environmental Analysis unfolded, it became apparent that the Urban Renewal Plan might not be the only nor the most appropriate framework for evaluating the alternatives. The Boston Redevelopment Authority, consequently, undertook a reappraisal of the Urban Design objectives. No plan changes resulted, but changes in emphasis of design objectives were recommended. The BRA document referred to as the January 9, 1975 Report summarizes the reappraisal.

The inquiry:

- Assesses and redefines the land parcels within the Urban Renewal Plan boundaries.
- Suggests more stringent building bulk limitations.
- Proposes a more flexible Boylston Street setback limitation and recommends setback controls for Stuart Street.
- Reverses the orientation emphasis for pedestrian circulation from east-west to north-south.
- Proposes the retention and rehabilitation of the Motor Mart parking garage and suggests a realignment of Eliot Street.
- Refines the criteria for Open Space.
- Elaborates on the objectives for mixed functional uses.
- Refines the articulation of urban design objectives and suggests a land use approach as a strategy for achieving them.
- Identifies the need to include the Statler-Hilton property more specifically within the Urban Renewal Plan design objectives and controls.

To simplify the analysis of impacts, however, the above phases have been grouped according to the specific EBA models used for testing as follows:

1975 EBA Model:

Acquisition

Relocation

Disposition

Demolition

1980 EBA Model

Excavation/Site Preparation

Construction

1985 EBA Model

Occupancy and Use

So that for each alternative, the affects of occupancy and use for example, are evaluated in 1985, whether project completion is : 1980 (2,3,4 million alternatives) or 1985 (5,6 million alternatives).

DPI Impact Generators

Actions affecting the environment are derived from the legal, financial, physical and demographic components of the DPI in accordance with the phasing plan:

Phase A - Acquisition Requirements

o Public and private properties reauired for the alternative are identified and acquisition costs are calculated.

Section II of the January 9, 1975 Report concludes that the most practicable methodology for defining alternatives ranging between two million and five million square feet is to reduce the land area acquired (consequently land acquisition costs).

Land surrounding Charles Street which includes the highest proportion of vacant land, surface parking and redundant City streets is proposed to comprise the lowest density (two million and three million square feet) alternatives. The strategy for defining land coverage areas for middle density alternatives presupposes incremental addition of adjacent land parcels and increasing land acquisition costs, up to the highest density (six million square feet) alternative which includes the total urban renewal area. (minus the Little, Walker and Colonial buildings)

DPI Alternative Definitions

The Boston Redevelopment Authority extended the January 9, 1975 Report rationale in a report entitled, Defining the Alternatives, dated February 4, 1975. Alternatives defined are designated six million, five million, four million, three million and two million square feet, approximating the total of new and retained existing floor area proposed within the project boundary.

Subsequently, at the urging of the Civic Advisory Committee, the three million square foot alternative was redescribed to more closely represent the nominal three million square foot density designation. This redescribed Three Million Alternative is portrayed and evaluated herein.

Alternative definitions include:

- A development program consisting of new and existing floor areas tabulated by functional use; i.e., retail, office, apartment, parking, hotel.
- A physical configuration intended to represent the scale and visual impact of each alternative density. The physical configuration illustrations depict general on-site land uses and building mass.

DPI Alternative Phases

Phases of the development process which generate actions affecting the environment have legal, financial, physical and demographic characteristics.

Legal and financial actions include:

- Public acquisition of property

- Disposition of property to private and public interests for redevelopment

Physical actions include:

- Demolition of existing structures
- Excavation and site preparation
- Construction of new buildings and improvements

Demographic actions include:

- Relocation of existing residents and businesses
- Occupancy and use of the completed project

In order to "load" the project actions on the Environmental Base Models, a staging plan for each alternative has been assumed. The staging plan schedules the above-described project actions over time extending from 1975 through 1990.

The two million alternative is envisioned as one-stage construction to be implemented by 1980. The three million and four million alternatives envision a second-stage extending to 1980 and the five million and six million alternatives anticipate three stages to be completed prior to 1985.

Phase B - Relocation Requirements

- The number, location and characteristics of residents and businesses to be relocated are determined.

Phase C - Disposition Plan

- Desired reuse of the project site is determined, and property to be disposed of for public and private development purposes is displayed and disposition costs are estimated.

Phase D - Demolition Plan

- Structures, including site improvements, in the project area requiring demolition and clearance are identified.

Phase E - Excavation and Site Preparation Plan

- Areas requiring excavation are determined and approximate excavation depths are identified.
- Construction labor force requirements and materials costs are estimated.

Phase F - Construction Plan

- Building locations and massing elements are depicted for analysis of geological, visual, shadow and near-ground wind effect impacts.
- Major site improvements are identified.

Phase G - Occupancy and Use Requirements

- Functional use mixes of new floor area are determined.

- Estimated user population and business activity of the new project are determined and displayed in a series of demographic tables.
- Market demands are estimated.
- Financial feasibility is evaluated.
- Circulation including parking and pedestrian loads are determined for transportation analysis.
- Utility demands are estimated for both public and private utility analysis.
- Functional service demands for public facilities serving the area are estimated.
- Noise generators are determined.

DEVELOPMENT PROGRAM INTERPRETATION

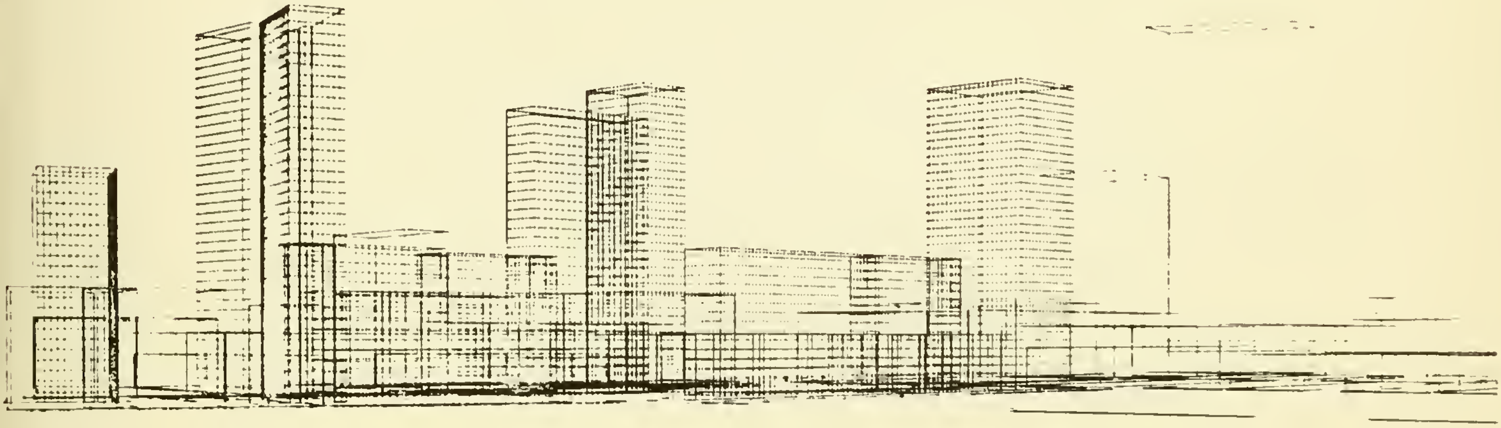
The DPI Alternatives displayed herein are as described by the Boston Redevelopment Authority report, Defining The Alternatives, dated February 4, 1975.

Each DPI Alternative description includes:

- A summary description.
- An illustrative site plan with accompanying description of buildings by functional use, floor areas, number of floors and vertical height.
- A rendered perspective drawn from the vantage point of the Park Street Church.
- A rendered perspective drawn from a vantage point at the corner of Arlington and Beacon Streets.
- Photographs of a model.

The plan and mass representations were constructed to illustrate the scale and visual impact of any given density. The delineation of these "designs" offer the opportunity to evaluate the Alternatives functionally and economically. They are not, however, proposed as architectural solutions.

The project mass depicted by the rendered perspectives was generated by computer graphics. Each new and existing structure within the area of concern was entered in the computer program by ground plane co-ordinates and vertical height. Coordinates for the vantage point were inputted and a line printer was employed to draw a mathematically constructed perspective as illustrated below.

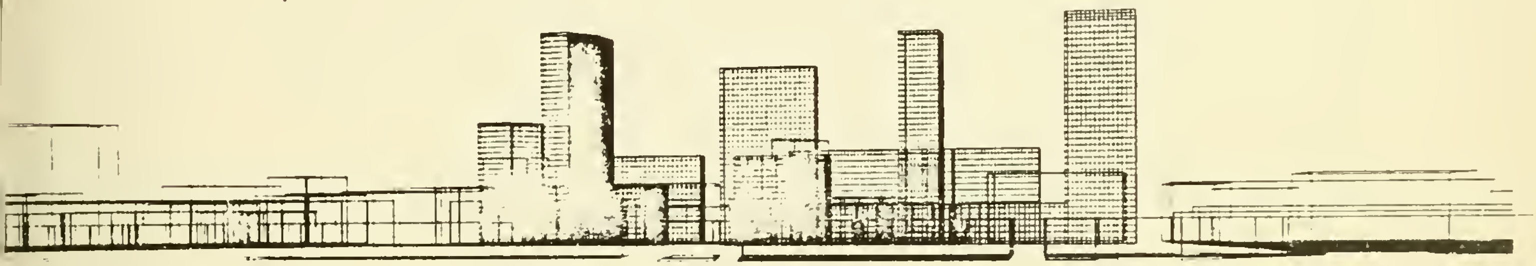


The drawings presented herein are tracings of the computer graphics with redundant lines omitted ... lines of hidden planes which in reality cannot be seen. The foreground approximates the actual conditions as recorded photographically. A minimum of "artists license" has been employed in the elimination of actual foliage to facilitate view of the project development.

The staging plan represents a reasoned judgment of the time frame anticipated for staged construction. It is structured to correlate with the 1975, 1980, 1985 Environmental Base Models.

SIX MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM SUMMARY



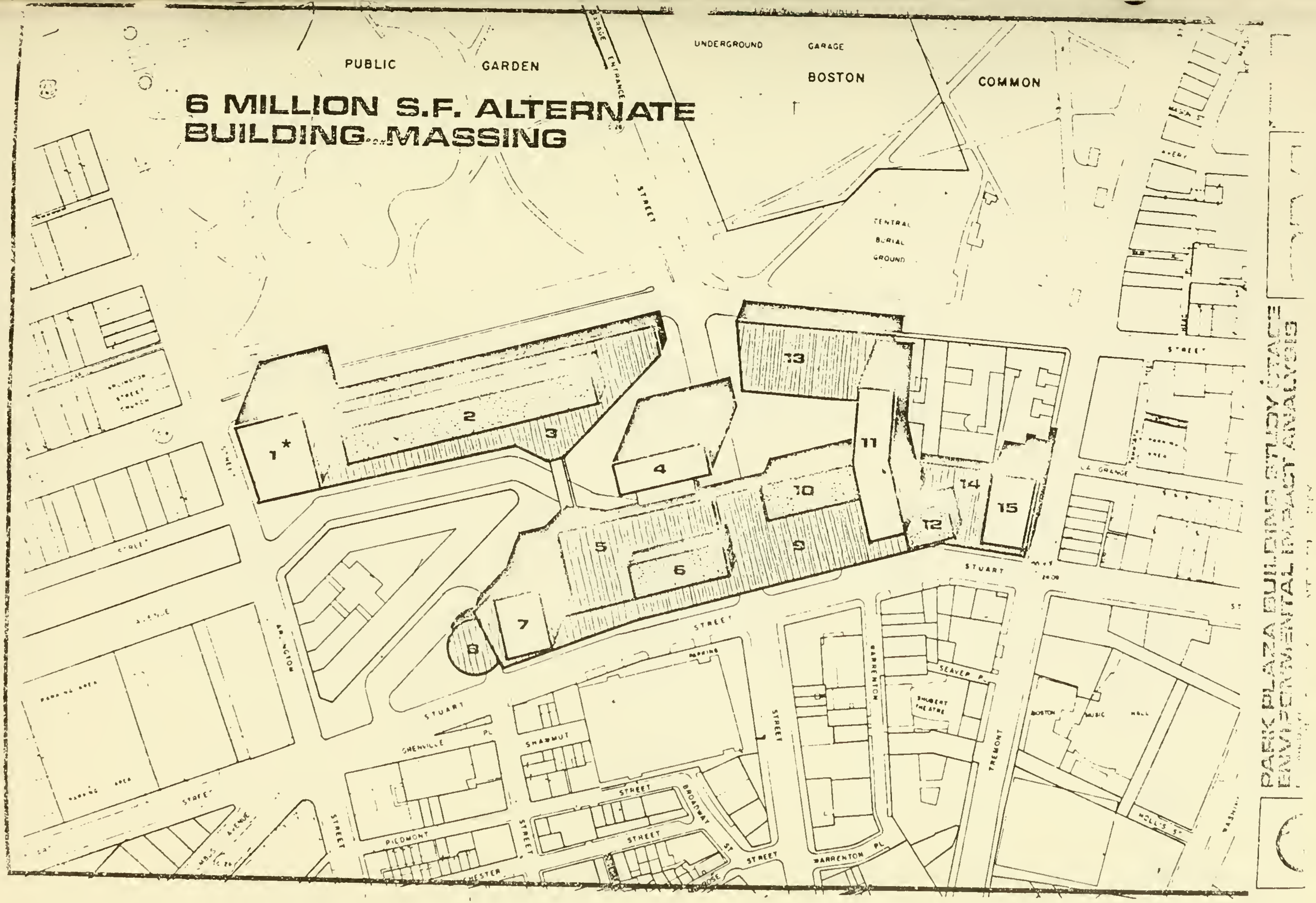
	Retained	New	Total
LAND COVERAGE AREA	0	455,899	455,899
FUNCTIONAL USE			
- Retail	0	352,000	352,000
- Offices	0	1,824,000	1,824,000
- Apartments	0	1,945,000	1,945,000
- Parking	0	1,144,000	1,144,000
- Hotel	0	581,000	581,000
TOTAL BUILDING AREA...........	0	5,847,000	5,847,000

NUMBER OF TOWER STRUCTURES................................5

This alternate is the maximum development allowed under the urban renewal plan. It approximates the scope and size of the developer's original proposal. Five towers result which, looking at the drawing above from left to right are two apartment towers, the hotel, a third apartment tower and the office tower. The tallest three towers are 450' feet high.

The alternative is silhouetted above as it would appear when completed but would be constructed in three distinct phases.

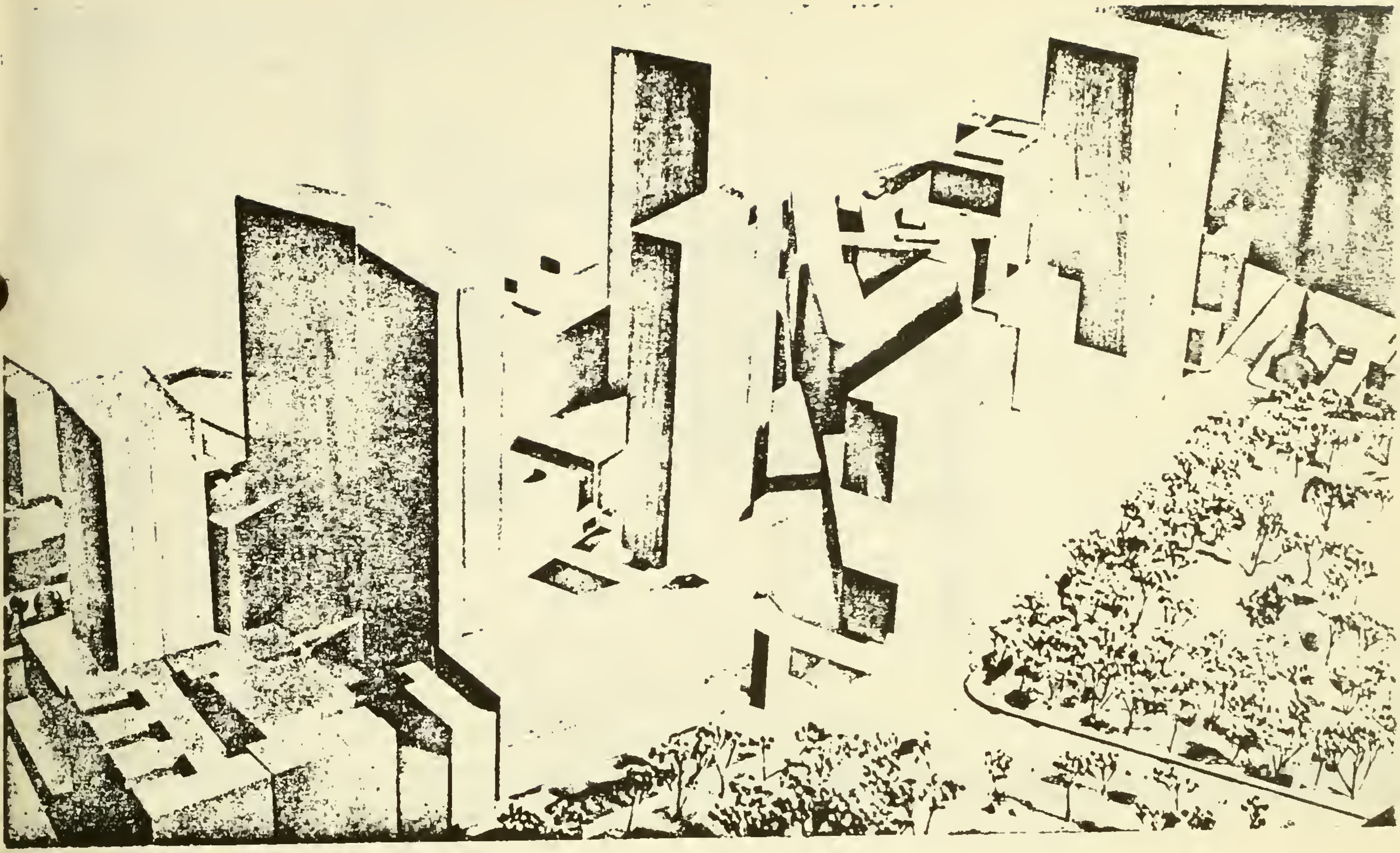
6 MILLION S.F. ALTERNATE BUILDING MASSING

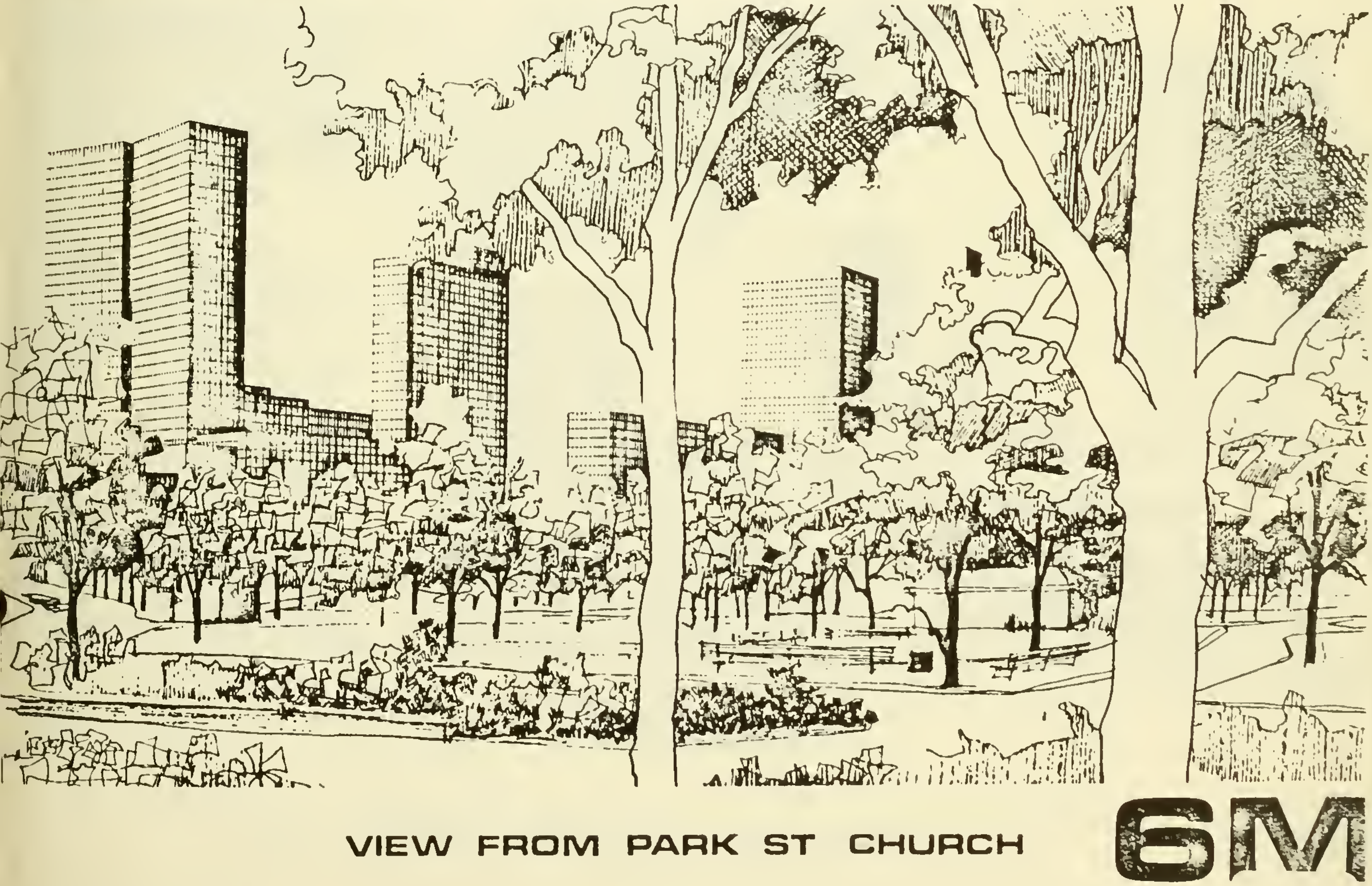


* The numbers shown here are keyed with the Table on the following page.

SIX MILLION SQUARE FEET

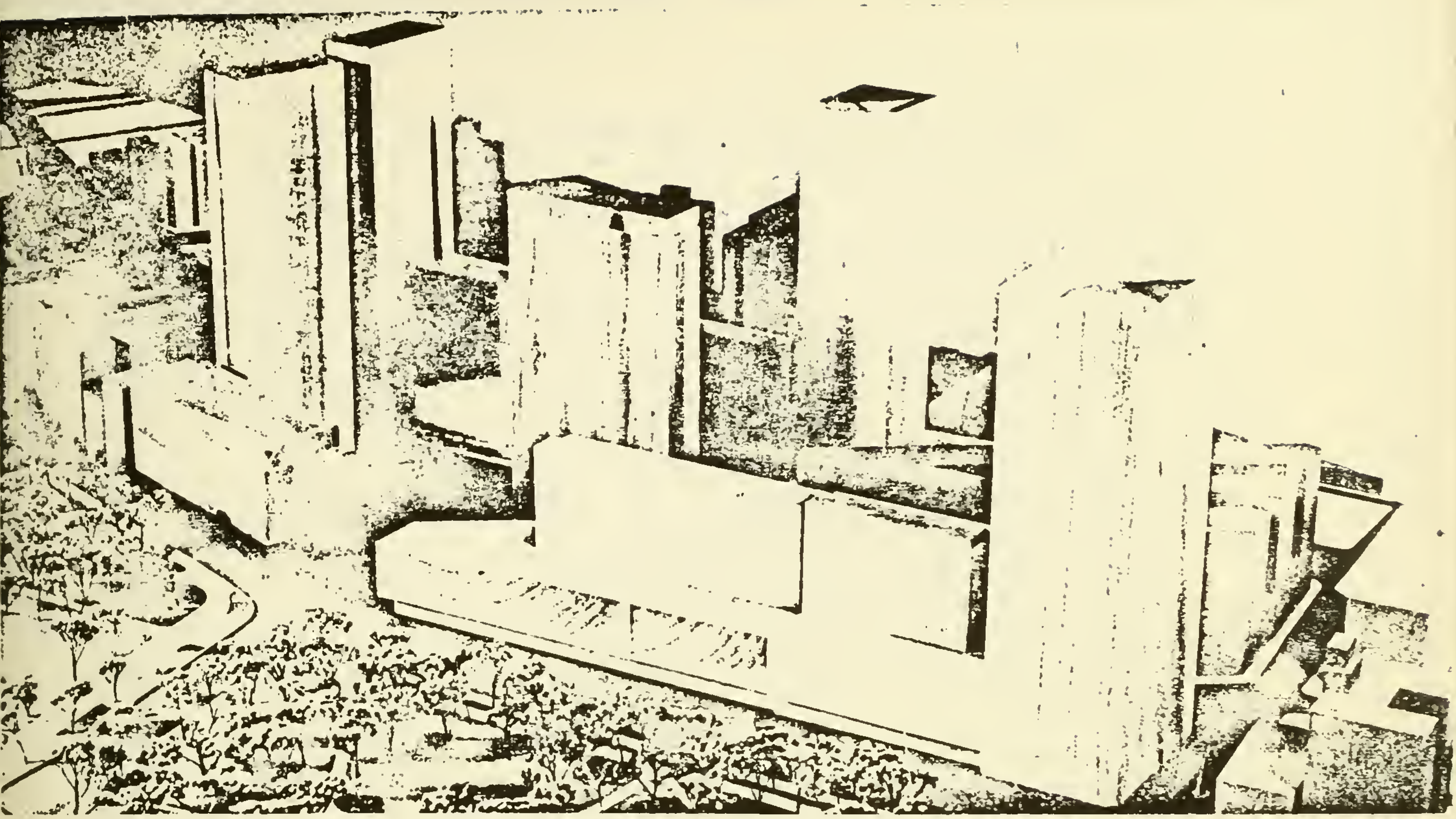
	FUNCTION	SQUARE FOOTAGE	FLOORS	TOTAL HEIGHT
1	Retail	23,000	2 Flrs (1 subgrade)	
	Offices	803,000	34 Flrs (2-35)	450'
2	Apartments	305,000	10 Flrs (7-16)	180'
3	Retail	133,000	2 Flrs (1 subgrade)	
	Offices	494,500	5 Flrs (2-6)	80'
4	Hotel			
	(Convention)	104,000	8 Flrs (1-8)	
	(Rooms)	377,000	29 Flrs (9-37)	370'
5	Convention	62,500	1 Flr (9)	100'
6	Apartments	130,000	10 Flrs (9-18)	200'
7	Apartments	432,000	36 Flrs (10-45)	450'
8	Parking Helix	66,500	7 Flrs (1-7)	80'
9	Retail	112,000	2 Flrs (1-2)	
	Parking	822,000	5 Flrs (3-7)	
	Parking Helix	66,500	7 Flrs (1-7)	
	Office	122,000	1 Flr (8)	
	Convention	37,500	1 Flr (8)	90'
10	Apartments	110,000	10 Flrs (9-18)	190'
11	Apartments	675,000	37 Flrs (9-45)	450'
12	Apartments	65,000	10 Flrs (9-18)	190'
13	Retail	53,000	2 Flrs (1 subgrade)	
	Offices	373,500	9 Flrs (2-10)	125'
14	Retail	31,000	2 Flrs (1-2)	
	Parking	135,000	5 Flrs (3-7)	
	Office	30,000	1 Flr (8)	90'
15	Apartments	228,000	19 Flrs (9-27)	280'

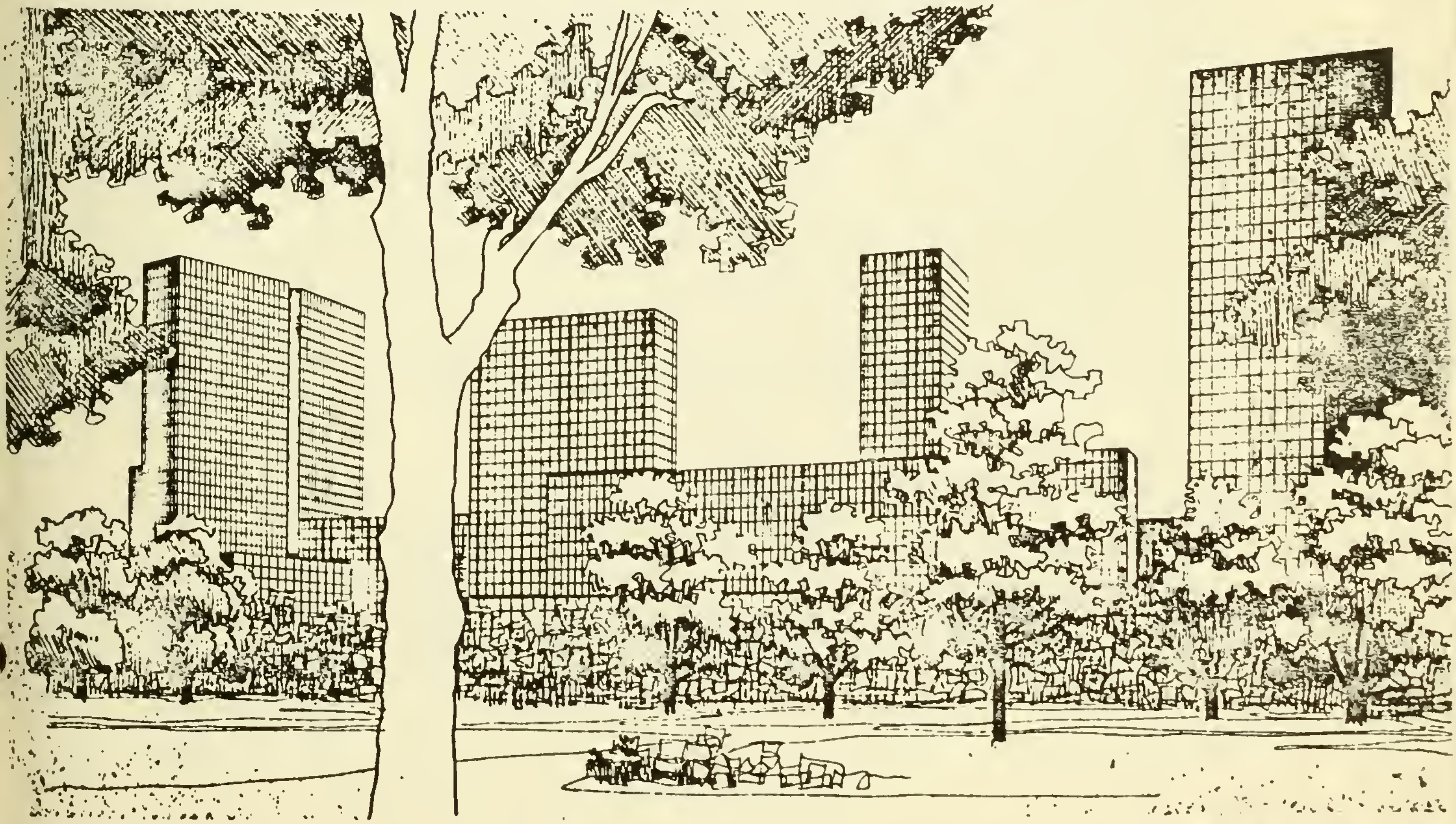




VIEW FROM PARK ST CHURCH

6M

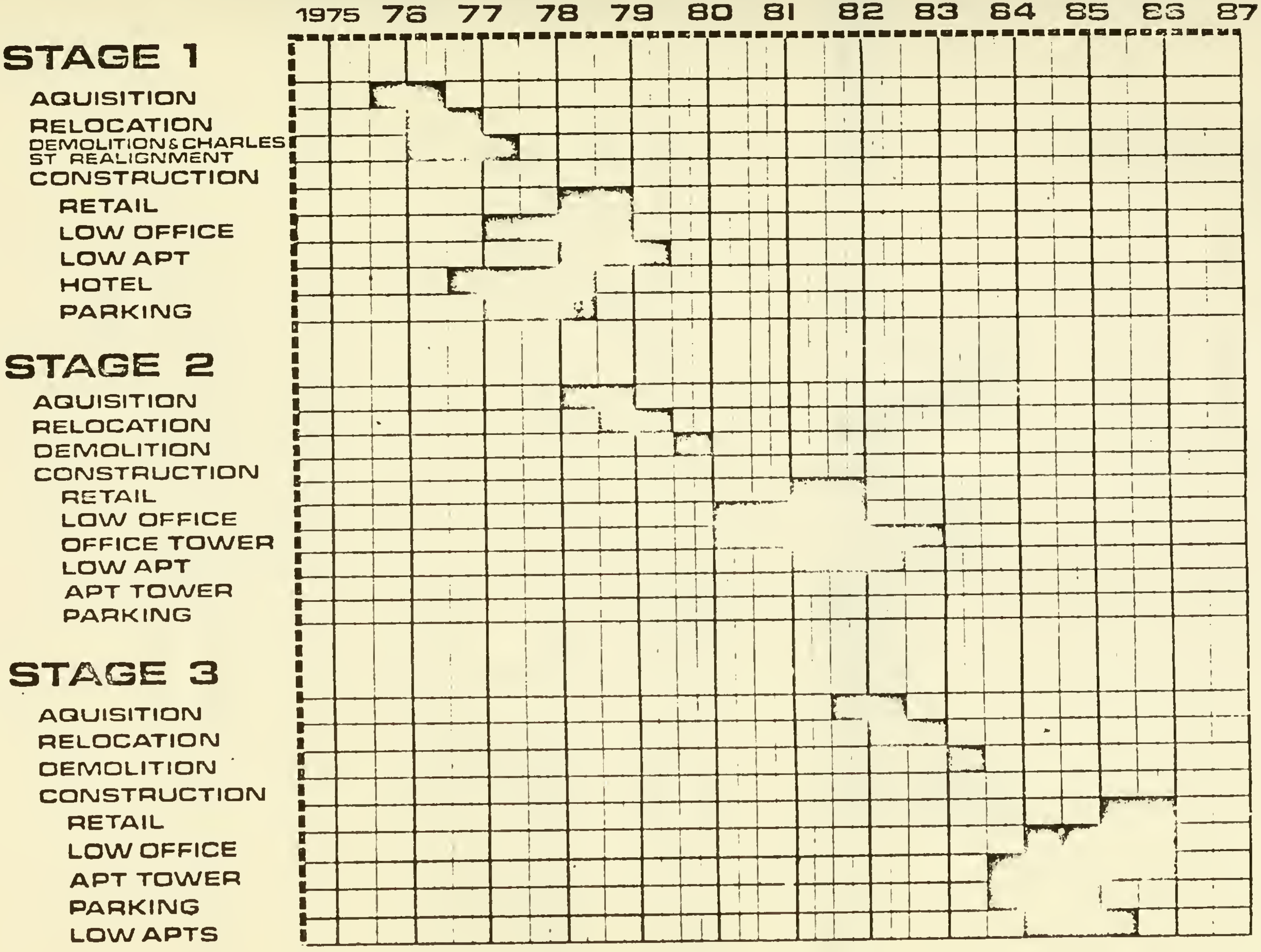




VIEW FROM BEACON & ARLINGTON ST

6M

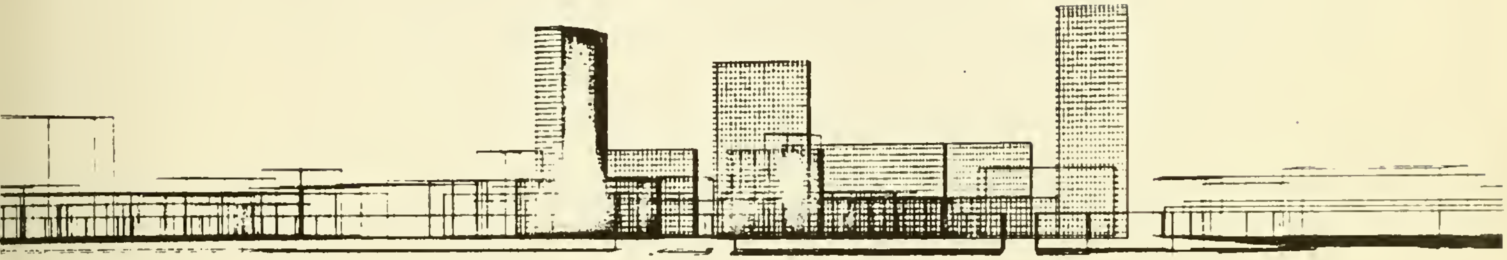
STAGING PLAN



PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
THE SARATOGA ASSOCIATES

FIVE MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM SUMMARY



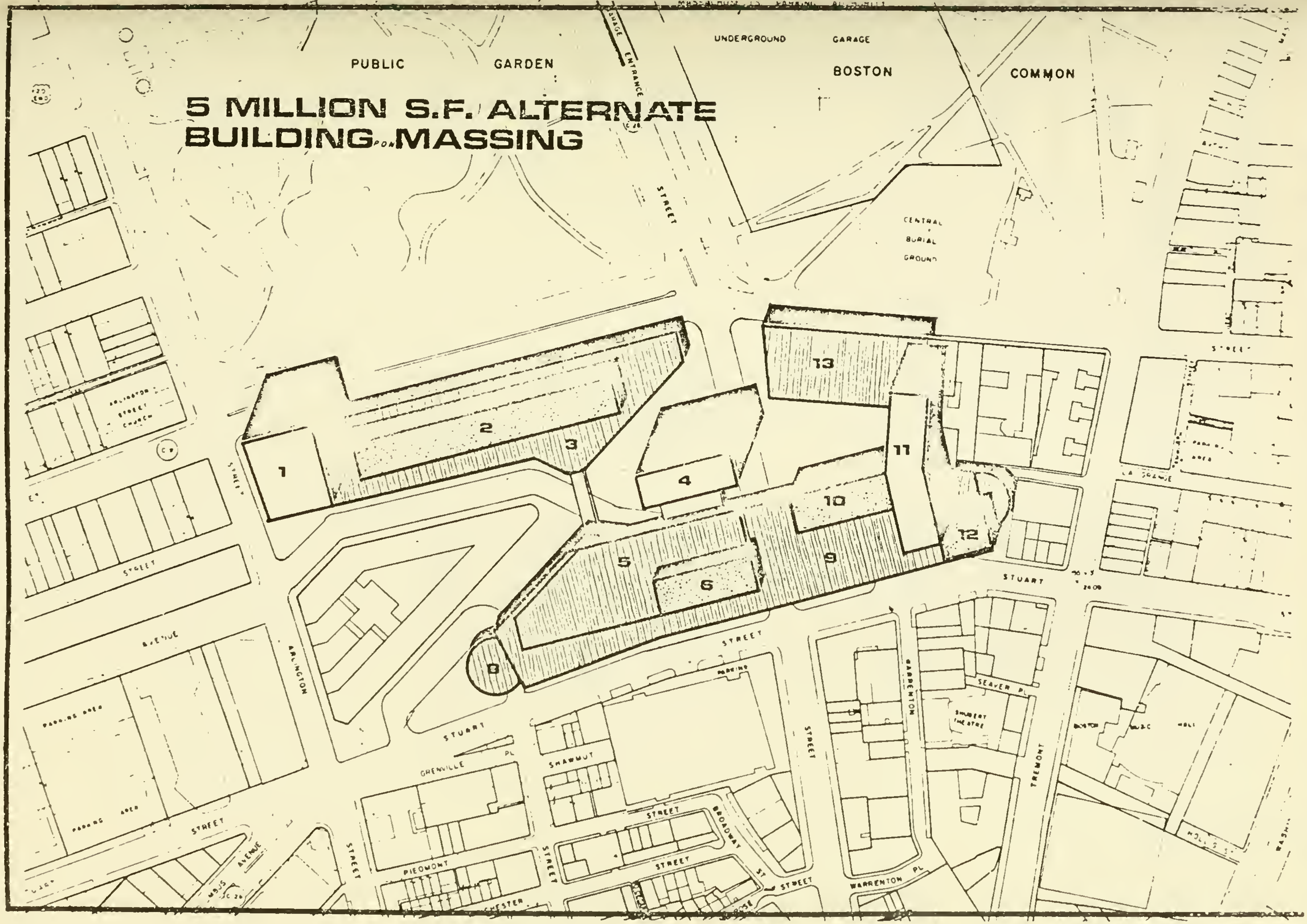
	Retained	New	Total
LAND COVERAGE AREA...........	20,277	435,622	455,899
FUNCTIONAL USE			
- Retail....................	33,169	321,000	354,169
- Offices...................	11,056	1,915,500	1,926,556
- Apartments................	0	1,285,000	1,285,000
- Parking...................	0	782,000	782,000
- Hotel.....................	0	581,000	581,000
TOTAL BUILDING AREA.........	44,225	4,884,500	4,928,725

NUMBER OF TOWER STRUCTURES..............................3

This alternative assumes the Saxon Theater subparcel is not acquired and the Motor Mart is acquired, but its structure reused.

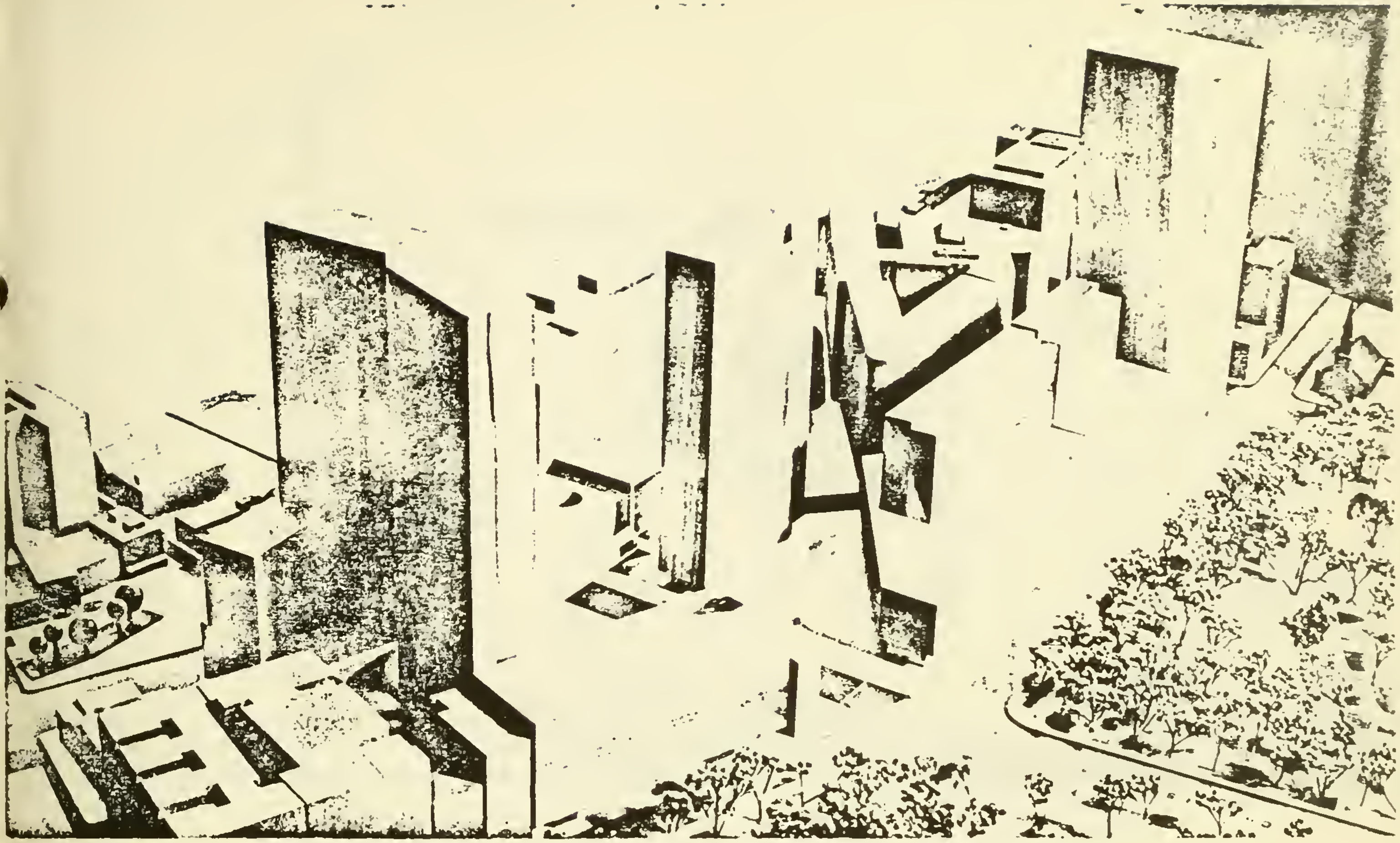
The major change in bulk from the previous maximum alternative is the elimination of the two apartment high rises on the Saxon and Motor Mart sites.

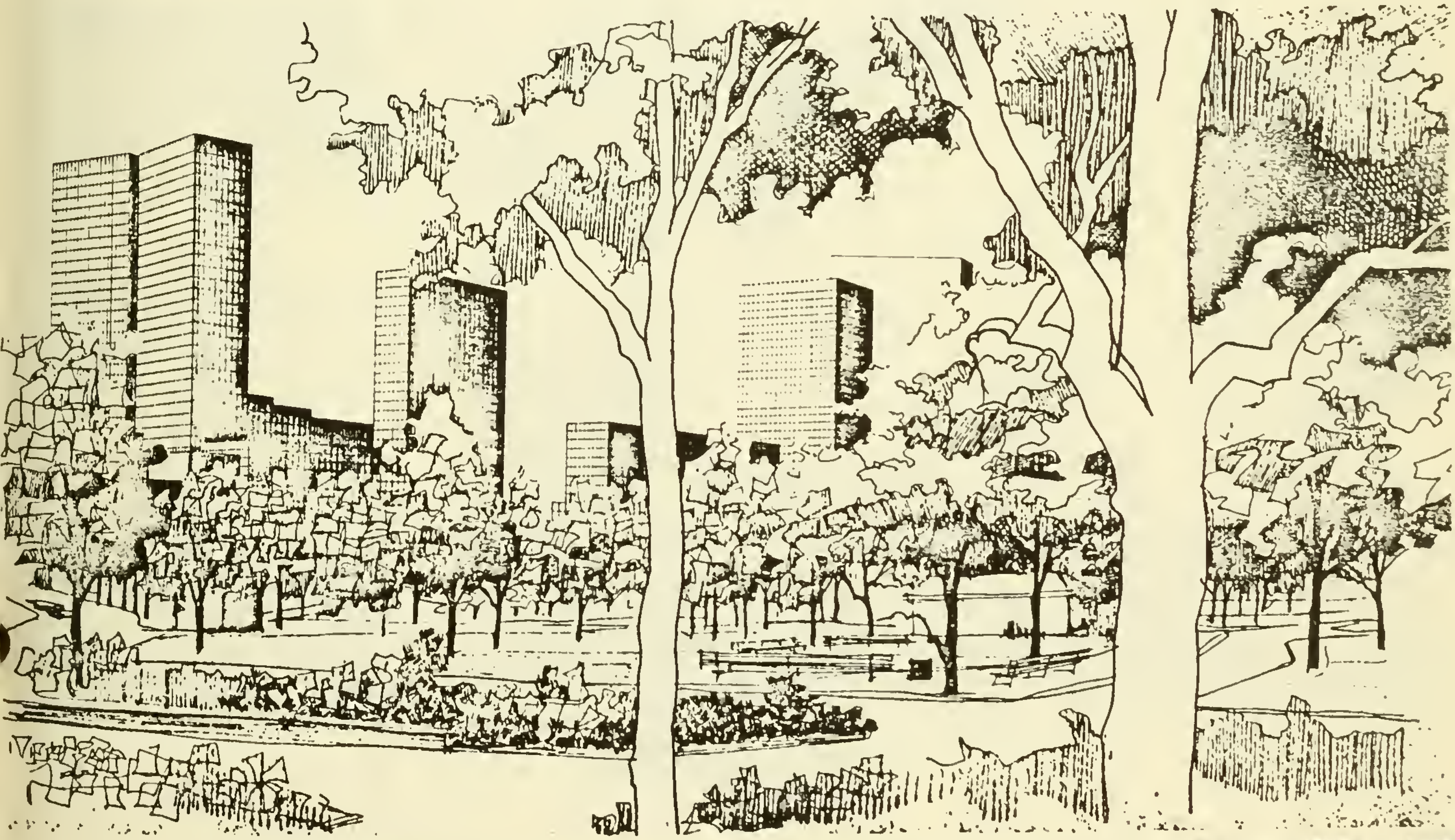
5 MILLION S.F. ALTERNATE BUILDING ON MASSING



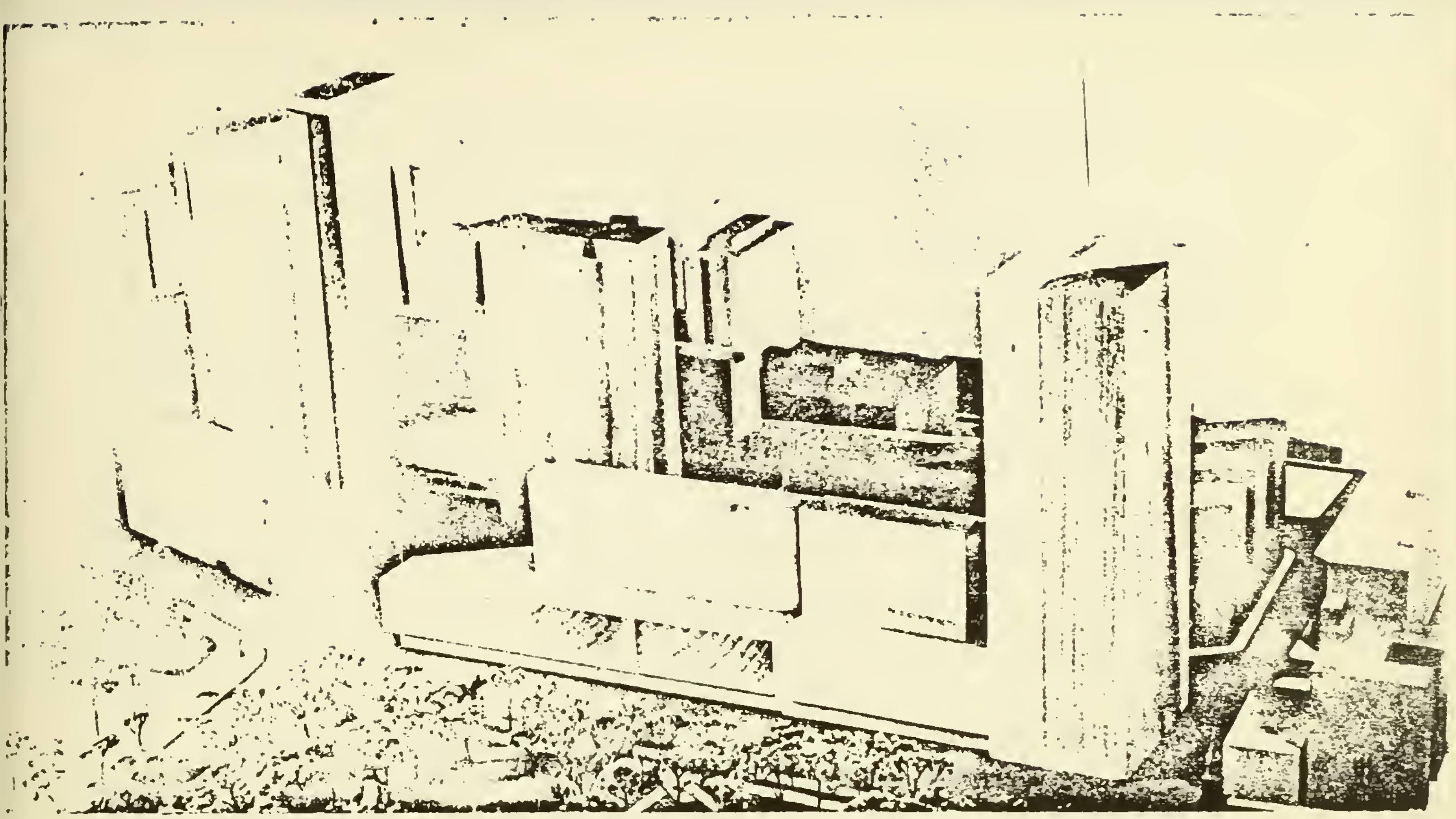
FIVE MILLION SQUARE FEET

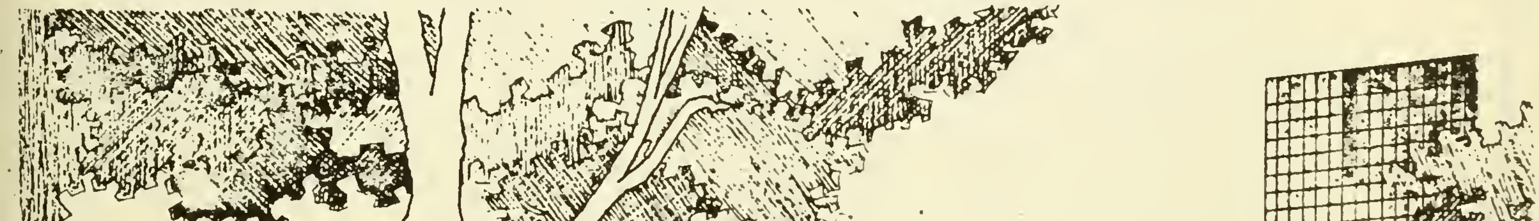
	FUNCTION	SQUARE FOOTAGE	FLOORS	TOTAL HEIGHT
1	Retail	23,000	2 Flrs (1 subgrade)	
	Offices	803,000	34 Flrs (2-35)	450'
2	Apartments	305,000	10 Flrs (7-16)	180'
3	Retail	133,000	2 Flrs (1 subgrade)	
	Offices	494,500	5 Flrs (2-6)	80'
4	Hotel			
	(Convention)	104,000	8 Flrs (1-8)	
	(Rooms)	377,000	29 Flrs (9-37)	370'
5	Convention	62,500	1 Flr (9)	100'
6	Apartments	130,000	10 Flrs (9-18)	200'
8	Parking Helix	57,000	6 Flrs (1-6)	70'
9	Retail	112,000	2 Flrs (1-2)	
	Parking	668,000	4 Flrs (3-6)	
	Parking Helix	57,000	6 Flrs (1-6)	
	Office	244,000	2 Flrs (7-8)	
	Convention	37,500	1 Flr (8)	90'
10	Apartments	110,000	10 Flrs (9-18)	190'
11	Apartments	675,000	37 Flrs (9-45)	450'
12	Apartments	65,000	10 Flrs (9-18)	190'
13	Retail	53,000	2 Flrs (1 subgrade)	
	Offices	373,500	9 Flrs (2-10)	125'



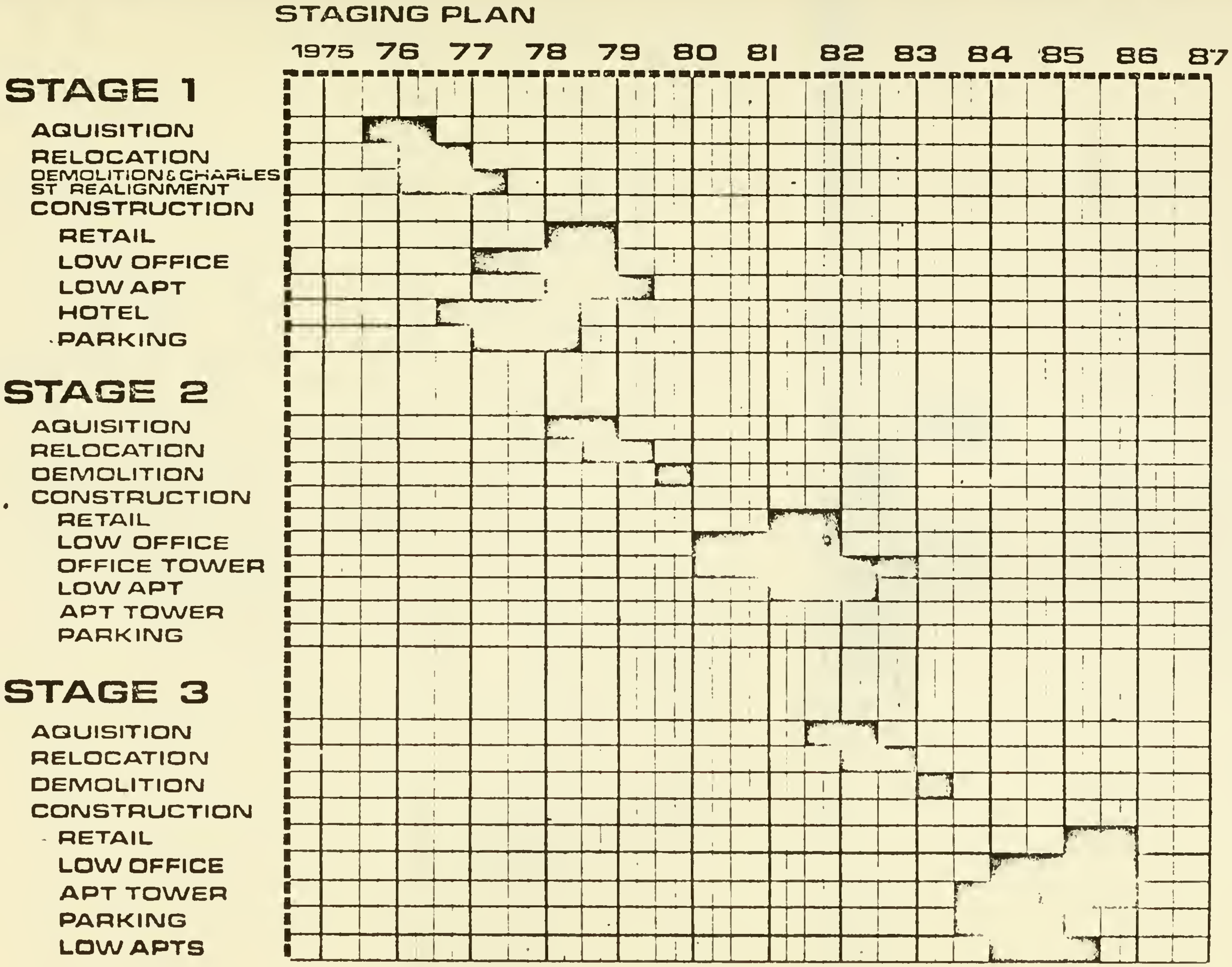


VIEW FROM PARK ST CHURCH





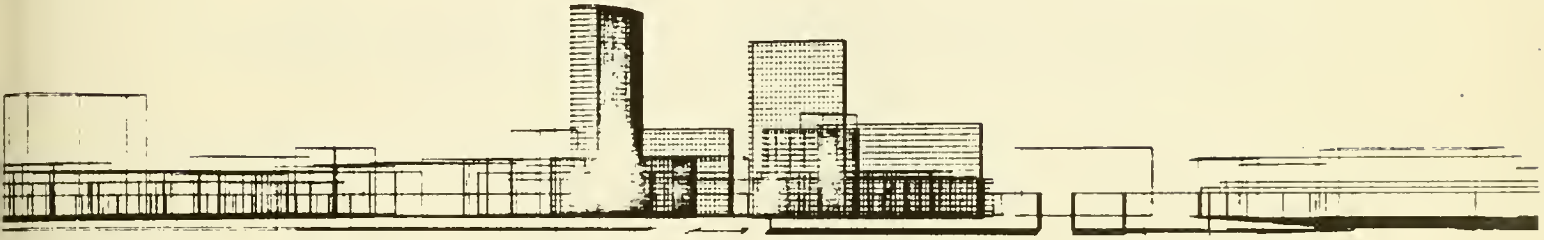
VIEW FROM BEACON & ARLINGTON ST



PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
THE SARATOGA ASSOCIATES

FOUR MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM SUMMARY



	Retained	New	Total
LAND COVERAGE AREA...........	80,452	375,477	455,899
FUNCTIONAL USE			
- Retail.....................	63,000	252,000	315,000
- Offices....................	199,500	1,092,000	1,291,500
- Apartments.................	0	1,175,000	1,175,000
- Parking....................	0	609,000	609,000
- Hotel......................	0	618,500	618,500
TOTAL BUILDING AREA..........	262,500	3,746,500	4,009,000

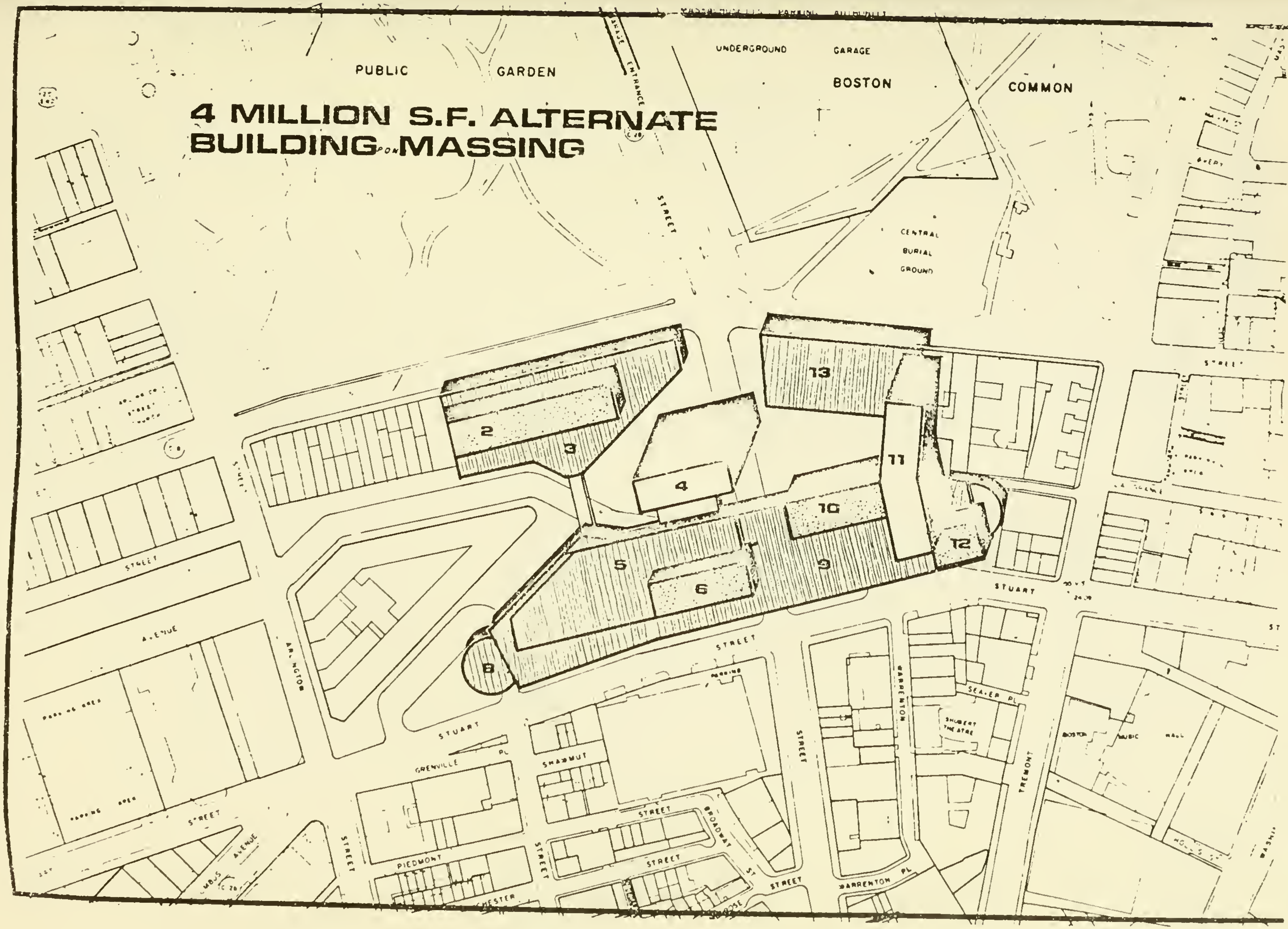
NUMBER OF TOWER STRUCTURES................................2

The reduction to the above alternative is achieved by eliminating the Arlington/Boylston Street sub-parcel along with the Saxon Theater sub-parcel and recycling the Motor Mart garage.

The hotel tower stands in the Park Square parcel and the 600 unit apartment tower to the east of it in the Eliot Street Garage parcel.

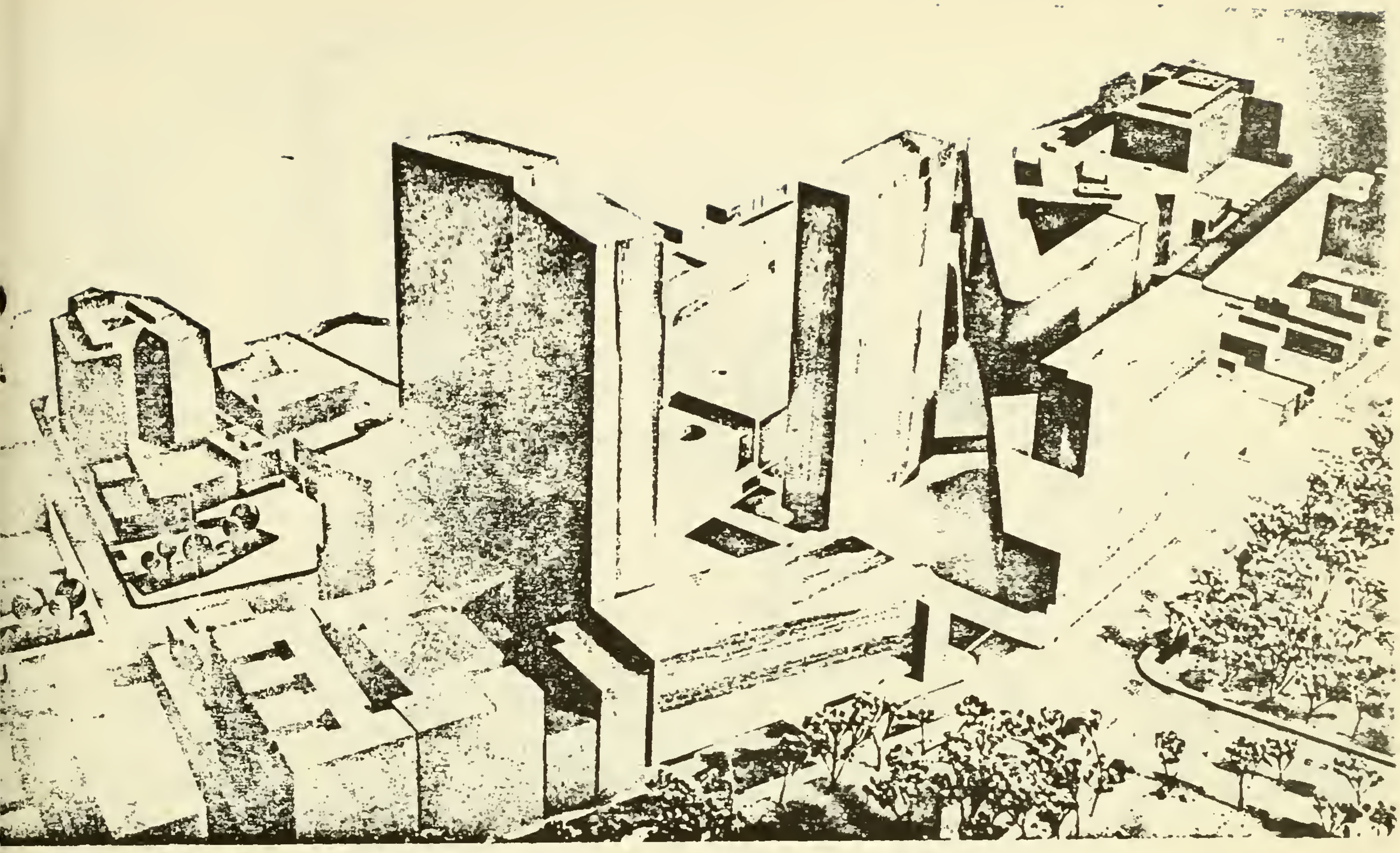
This project would still be carried out in two phases.

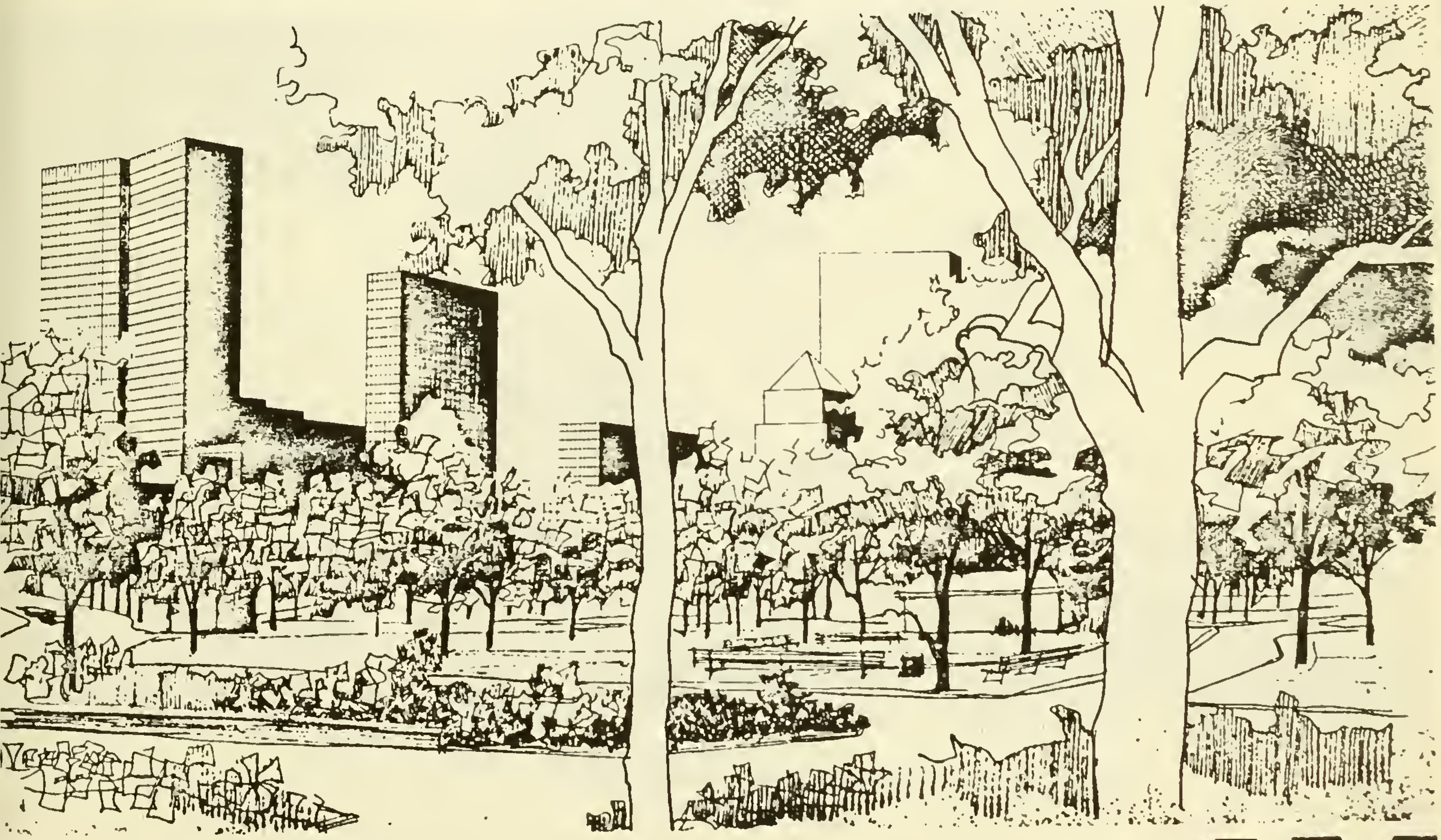
4 MILLION S.F. ALTERNATE BUILDING MASSING



FOUR MILLION SQUARE FEET

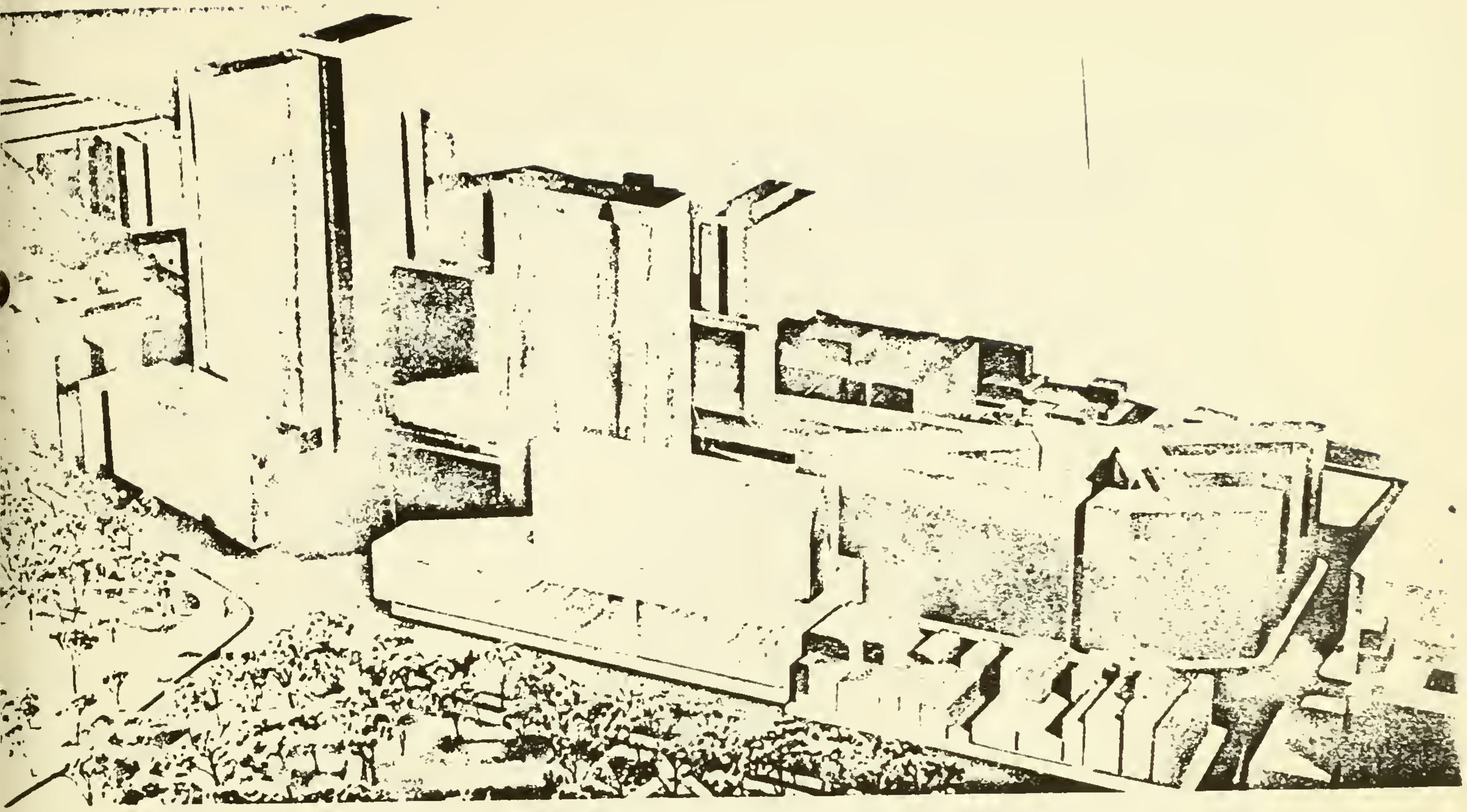
	FUNCTION	SQUARE FOOTAGE	FLOORS	TOTAL HEIGHT
2	Apartments	195,000	10 Flrs (7-16)	180'
3	Retail	87,000	2 Flrs (1 subgrade)	
	Offices	352,000	5 Flrs (2-6)	80'
4	Hotel			
	(Convention)	104,000	8 Flrs (1-8)	
	(Rooms)	377,000	29 Flrs (9-37)	370'
5	Convention	62,500	1 Flr (9)	100'
6	Apartments	130,000	10 Flrs (9-18)	200'
8	Parking Helix	47,500	5 Flrs (1-5)	60'
9	Retail	112,000	2 Flrs (1-2)	
	Parking	514,000	3 Flrs (3-5)	
	Parking Helix	47,500	5 Flrs (1-5)	
	Office	366,000	3 Flrs (6-8)	
	Convention	75,000	2 Flrs (7-8)	90'
10	Apartments	110,000	10 Flrs (9-18)	190'
11	Apartments	675,000	37 Flrs (9-45)	450'
12	Apartments	65,000	10 Flrs (9-18)	190'
13	Retail	53,000	2 Flrs (1 subgrade)	
	Offices	373,500	9 Flrs (2-10)	125'

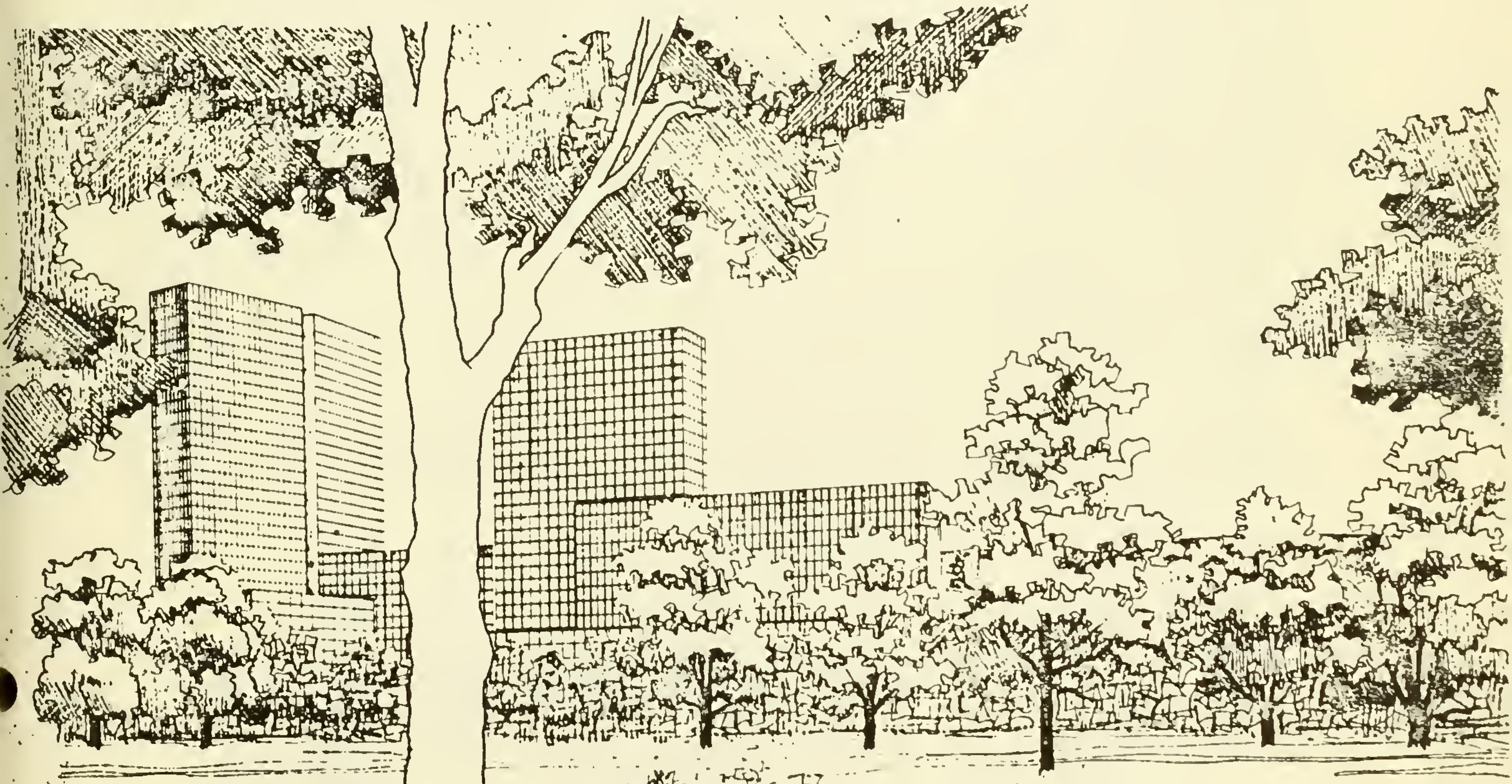




VIEW FROM PARK ST CHURCH

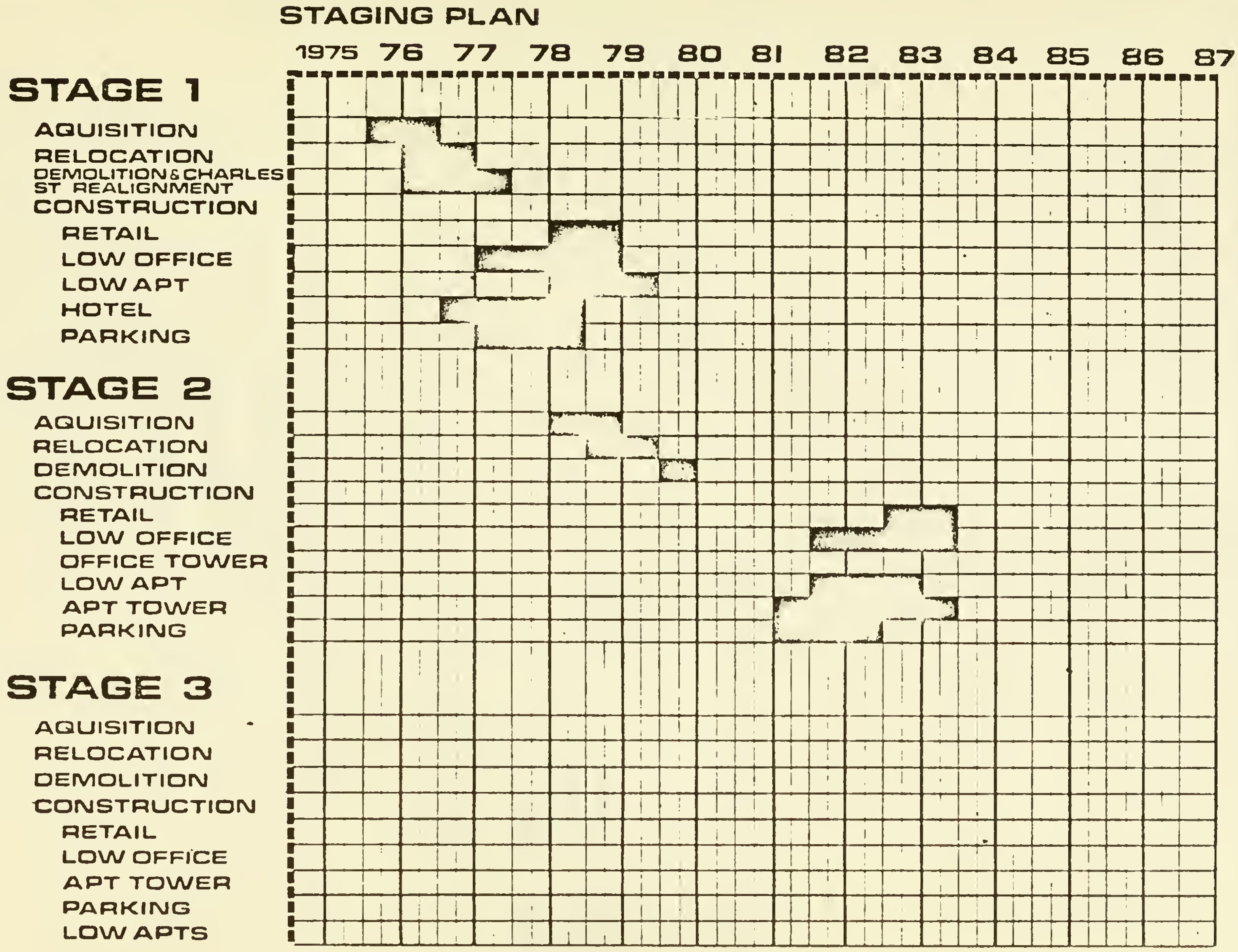
4M





VIEW FROM BEACON & ARLINGTON ST

STAGING PLAN



PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

BOSTON REDEVELOPMENT AUTHORITY

THE SARATOGA ASSOCIATES

THREE MILLION SQUARE FOOT ALTERNATIVE

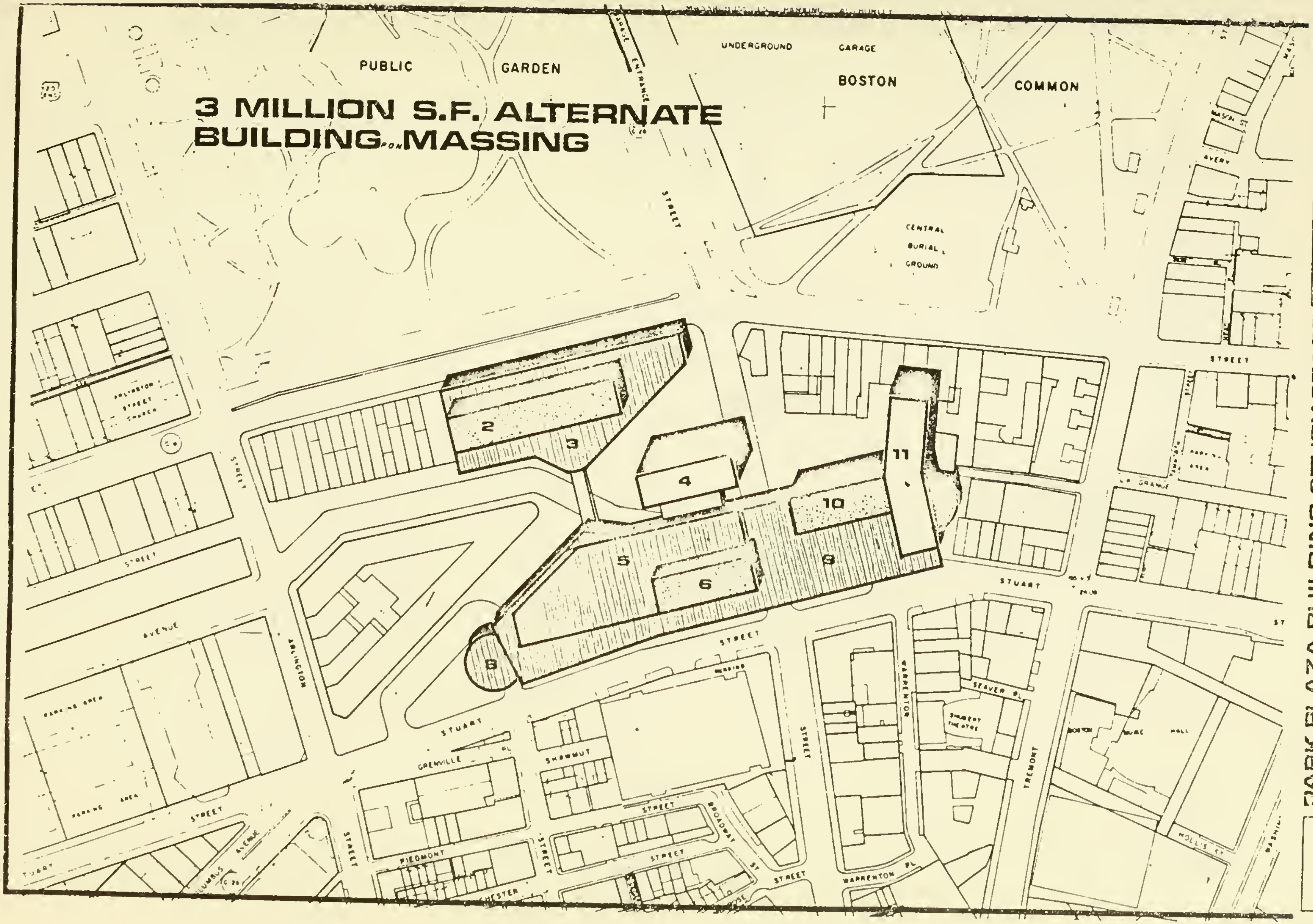
DEVELOPMENT PROGRAM SUMMARY

	Retained	New	Total
LAND COVERAGE AREA	130,210	325,689	455,899
FUNCTIONAL USE			
- Retail	105,500	198,000	304,500
- Offices	317,000	718,500	1,035,500
- Apartments	0	1,175,000	1,175,000
- Parking	0	609,000	609,000
- Hotel	0	618,500	618,500
TOTAL BUILDING AREA	422,500	3,320,000	3,742,500

NUMBER OF TOWER STRUCTURES................................2

In this alternative, the amount of development is reduced to the essential redevelopment of the core area. For a reduction from the preceding alternative, the sub-parcel between New Charles Street and Boylston Place is deleted from acquisition.

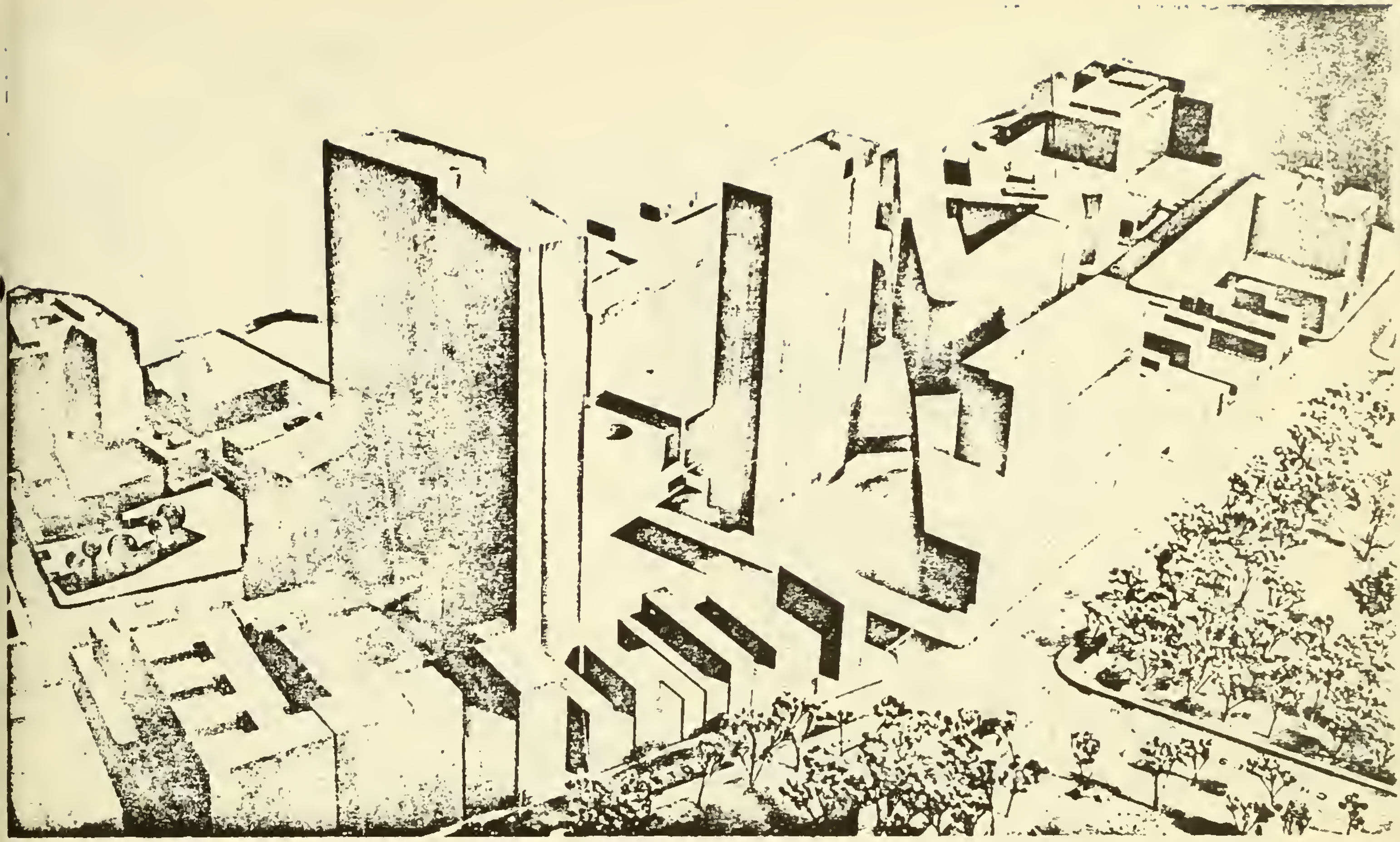
3 MILLION S.F. ALTERNATE BUILDING ON MASSING

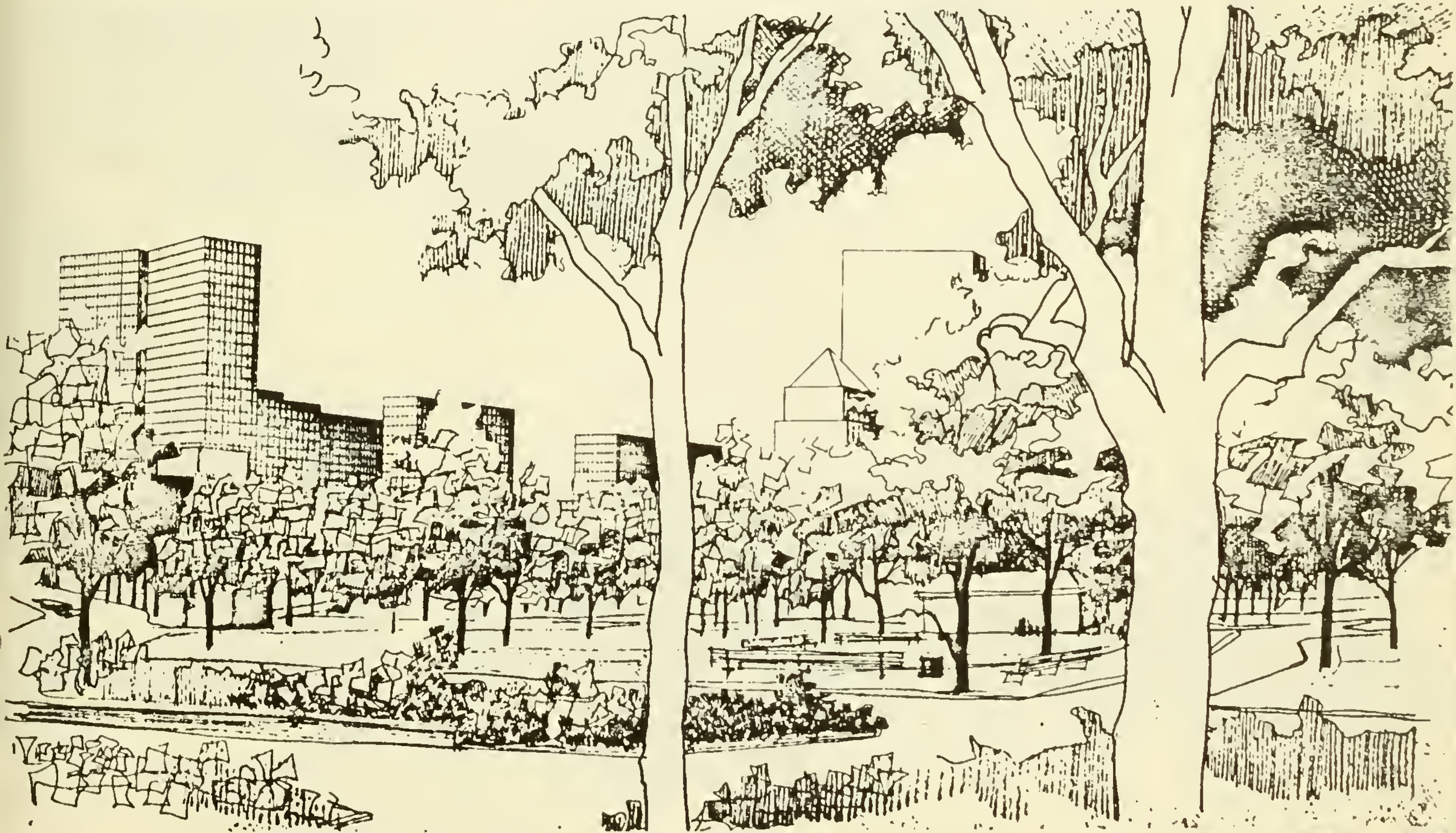


PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY

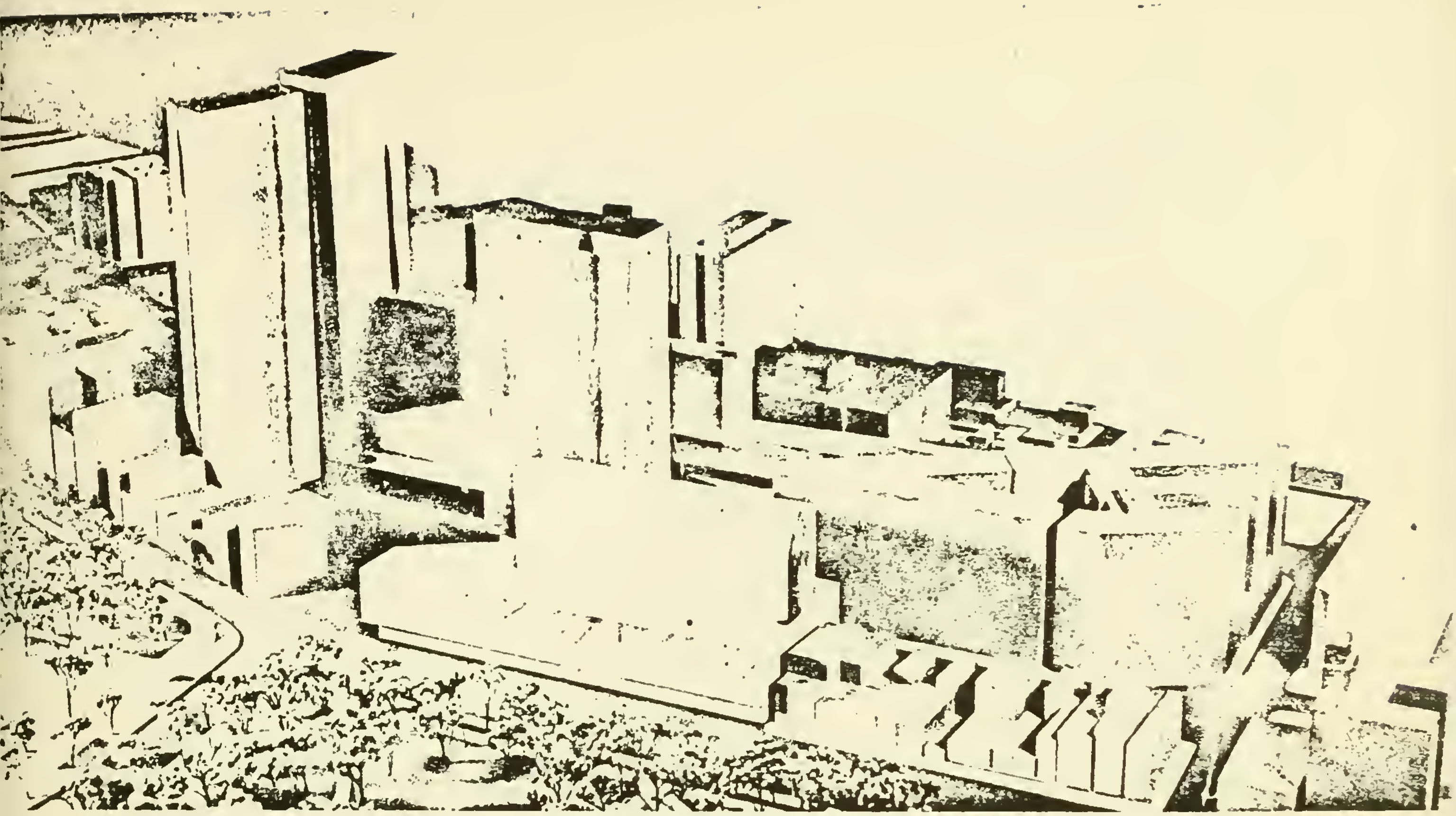
THREE MILLION SQUARE FEET

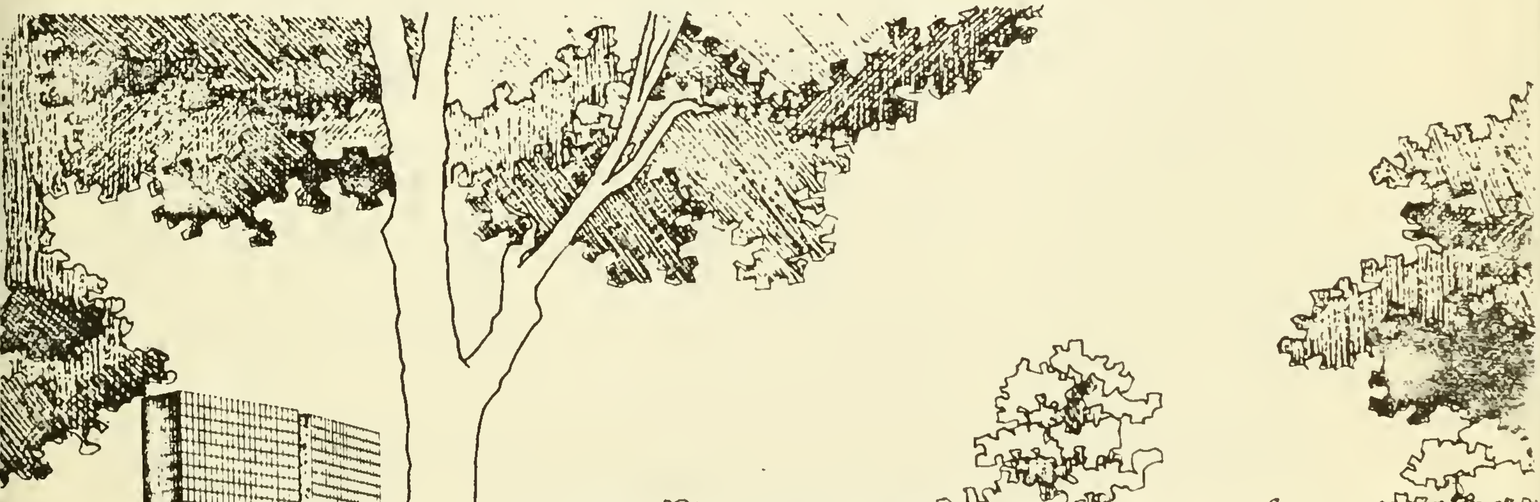
	FUNCTION	SQUARE FOOTAGE	FLOORS	TOTAL HEIGHT
2	Apartments	195,000	10 Flrs (5-14)	160'
3	Retail	87,000	2 Flrs (1 subgrade)	
	Offices	211,500	3 Flrs (2-4)	60'
4	Hotel			
	(Convention)	104,000	8 Flrs (1-8)	
	(Rooms)	182,000	14 Flrs (9-22)	220'
5	Convention	62,500	1 Flr (9)	100'
6	Apartments	130,000	10 Flrs (9-18)	200'
8	Parking Helix	47,500	5 Flrs (1-5)	60'
9	Retail	112,000	2 Flrs (1-2)	
	Parking	514,000	3 Flrs (3-5)	
	Parking Helix	47,500	5 Flrs (1-5)	
	Office	366,000	3 Flrs (6-8)	
	Convention	75,000	2 Flrs (7-8)	90'
10	Apartments	110,000	10 Flrs (9-18)	190'
11	Apartments	474,500	26 Flrs (9-34)	340'



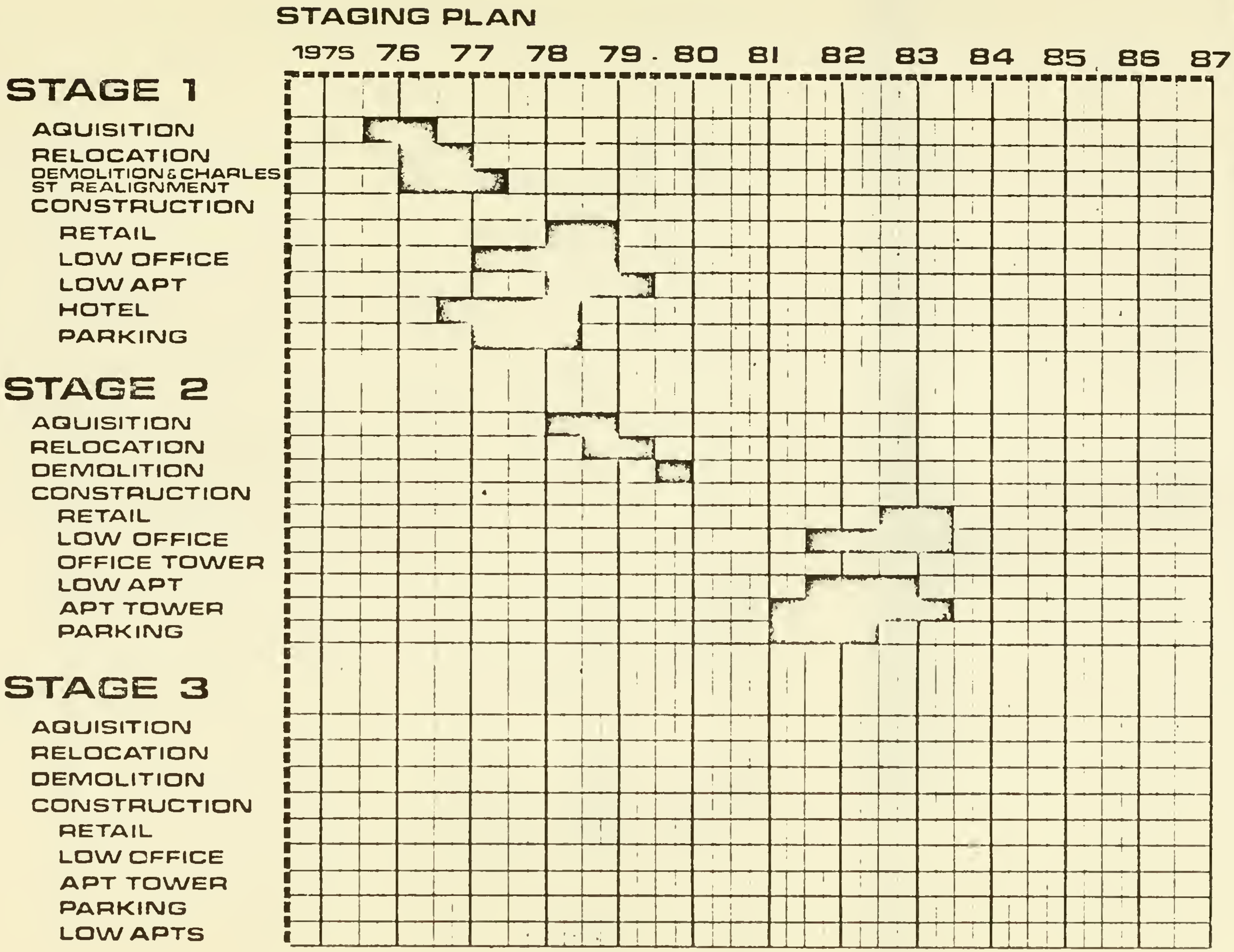


VIEW FROM PARK ST CHURCH





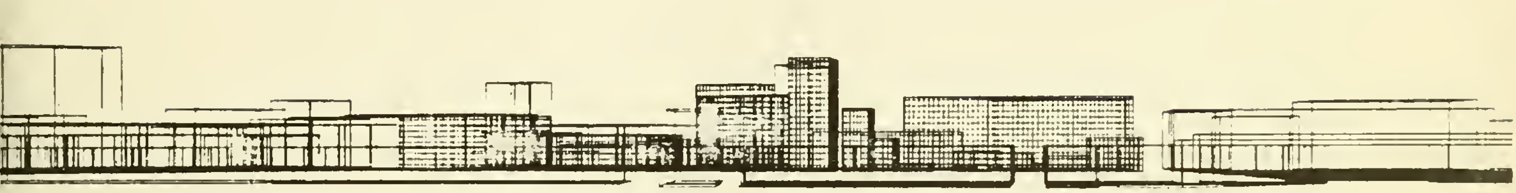
VIEW FROM BEACON & ARLINGTON ST



PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
BOSTON MASSACHUSETTS
THE SARATOGA ASSOCIATES
SARATOGA SPRINGS NEW YORK

TWO MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM SUMMARY



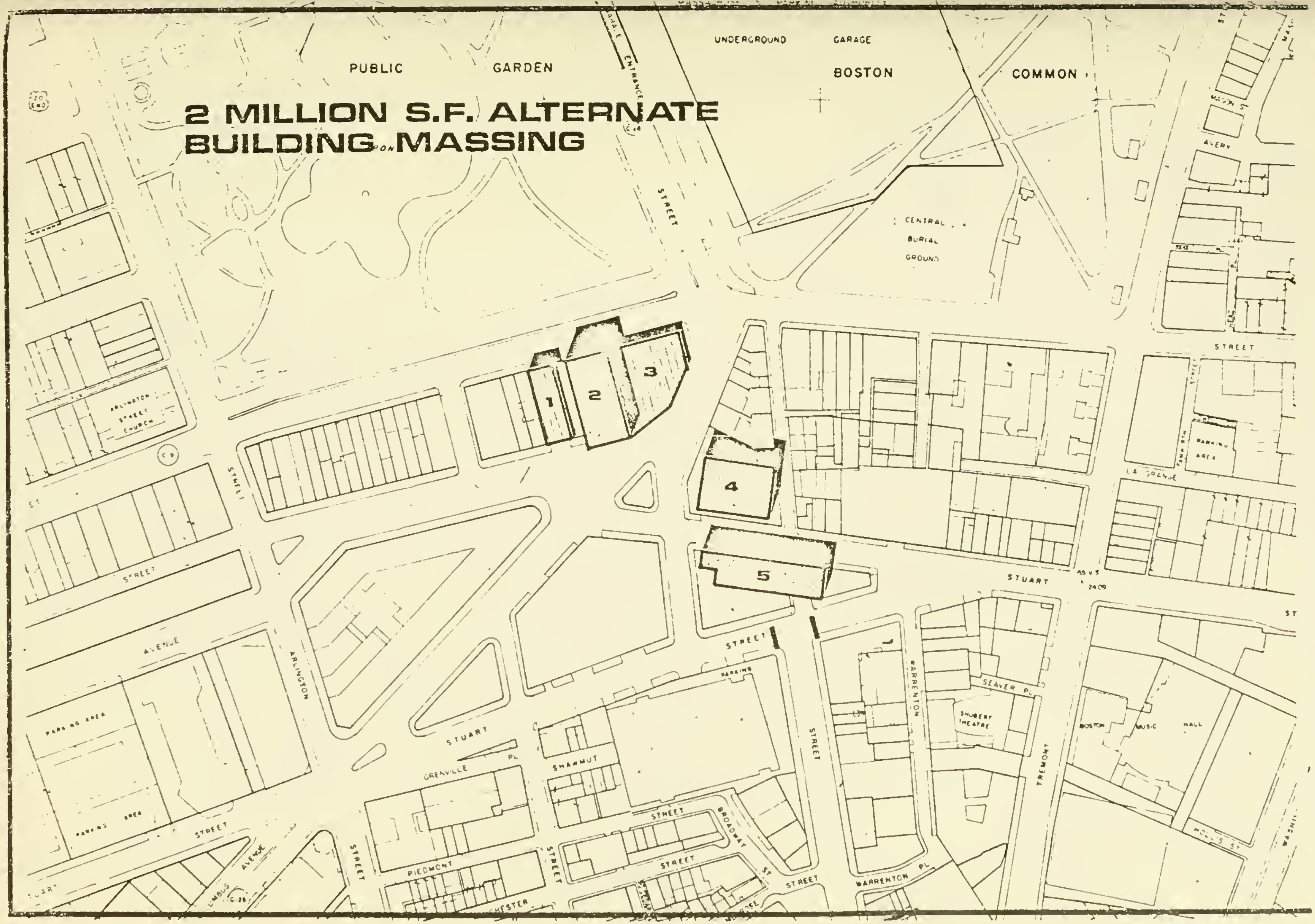
	Retained	New	Total
LAND COVERAGE AREA...........	370,324	85,575	455,899
FUNCTIONAL USE			
- Retail.....................	94,500	47,000	141,500
- Offices....................	534,500	351,500	886,000
- Apartments.................	0	407,500	407,500
- Parking....................	560,000	0	560,000
- Hotel......................	0	0	0
TOTAL BUILDING AREA..........	1,189,000	803,000	1,992,000

NUMBER OF TOWER STRUCTURES...............................0

This alternate - the "no build" option - assumes that only the four major empty lots in the area are developed: the two lots either side of the Playboy Club, the bus station, and the lot between Eliot Street and Stuart Street. Office development is assumed for the two Boylston Street lots and apartment development for the

two remaining sites to balance the use mix. Retail is located at the base of all four buildings. The size of these few new buildings is the maximum allowed under the zoning code (F.A.R. 10 and 8). No urban renewal action is involved.

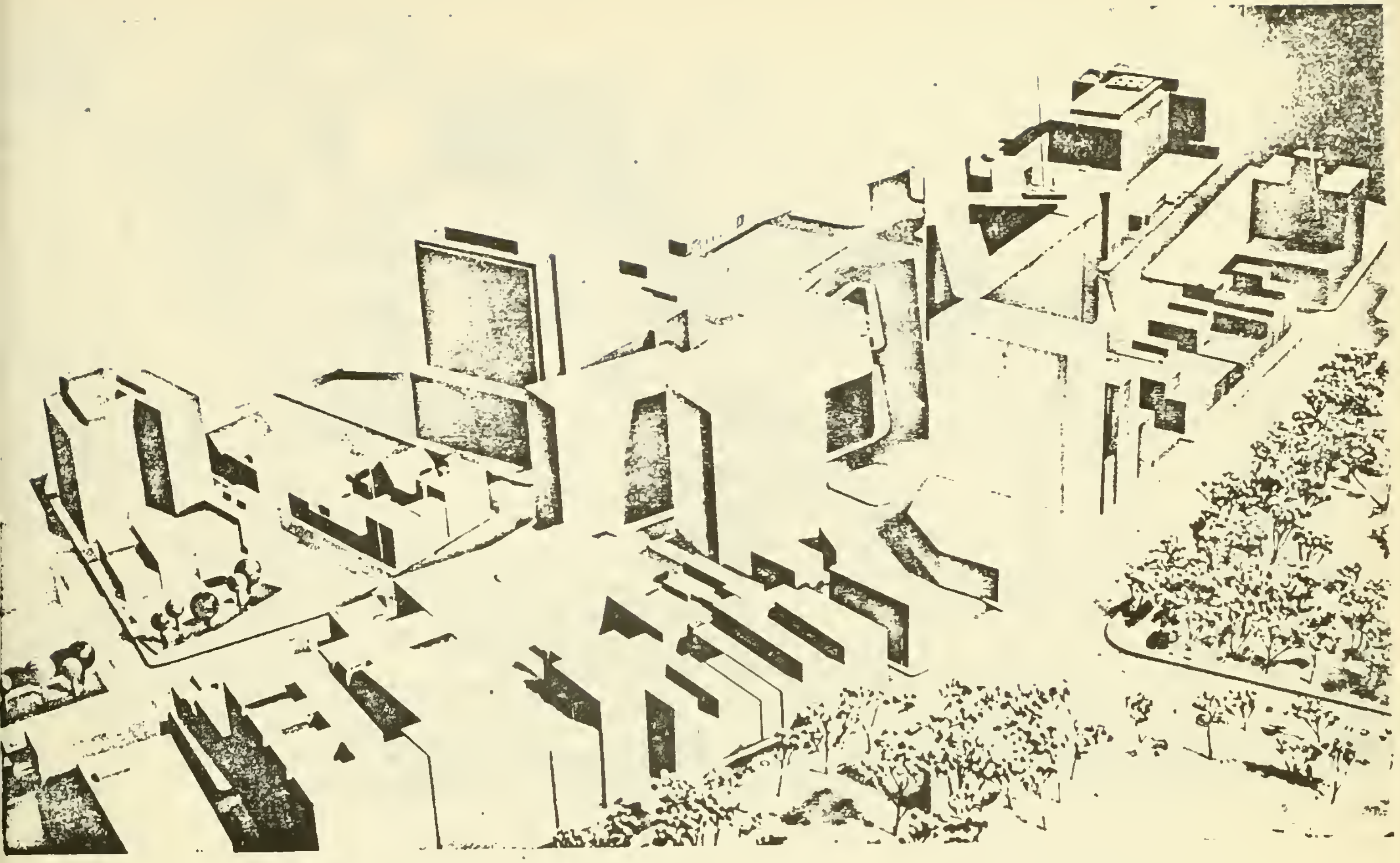
2 MILLION S.F. ALTERNATE BUILDING ON MASSING

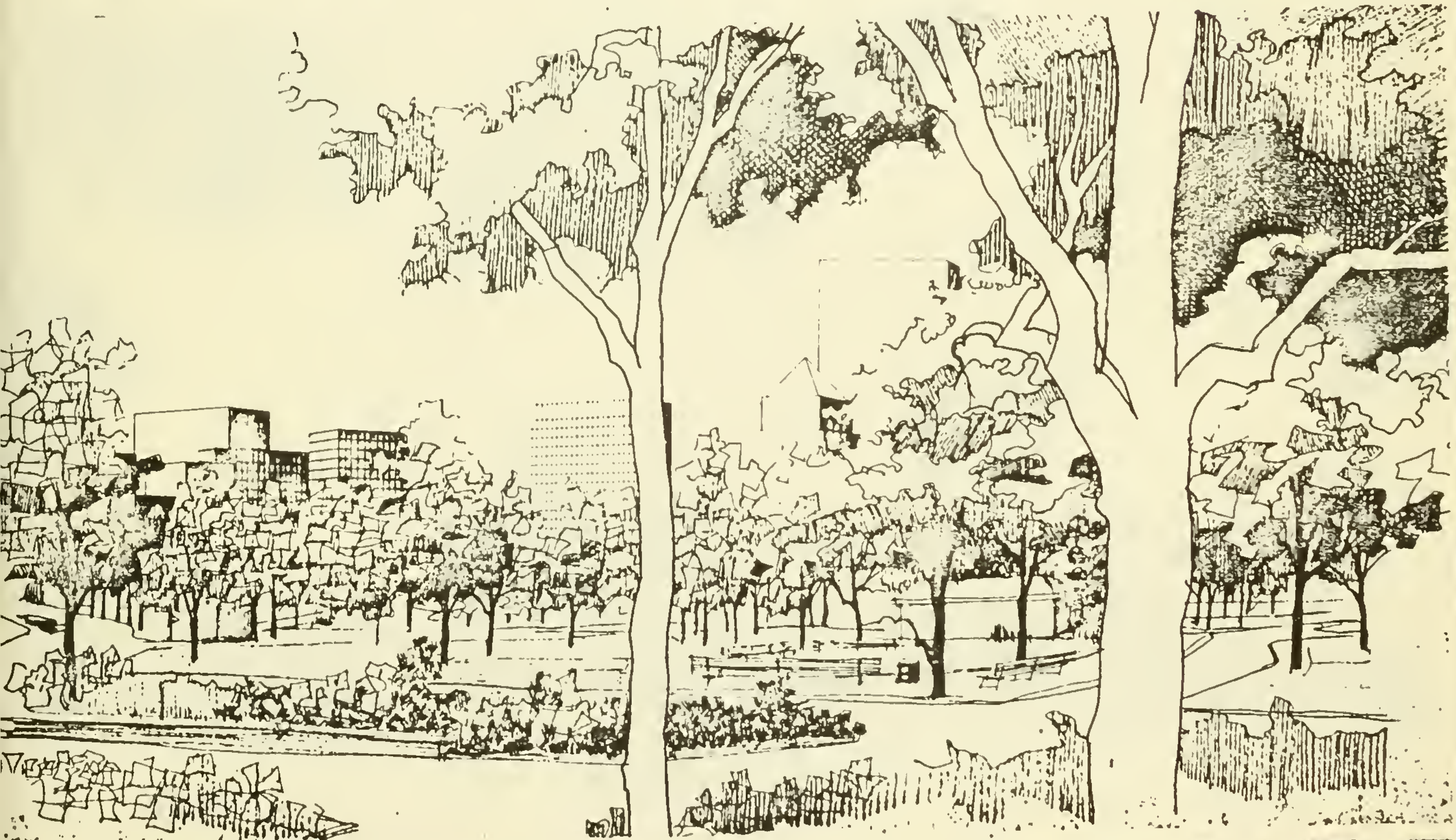


PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY

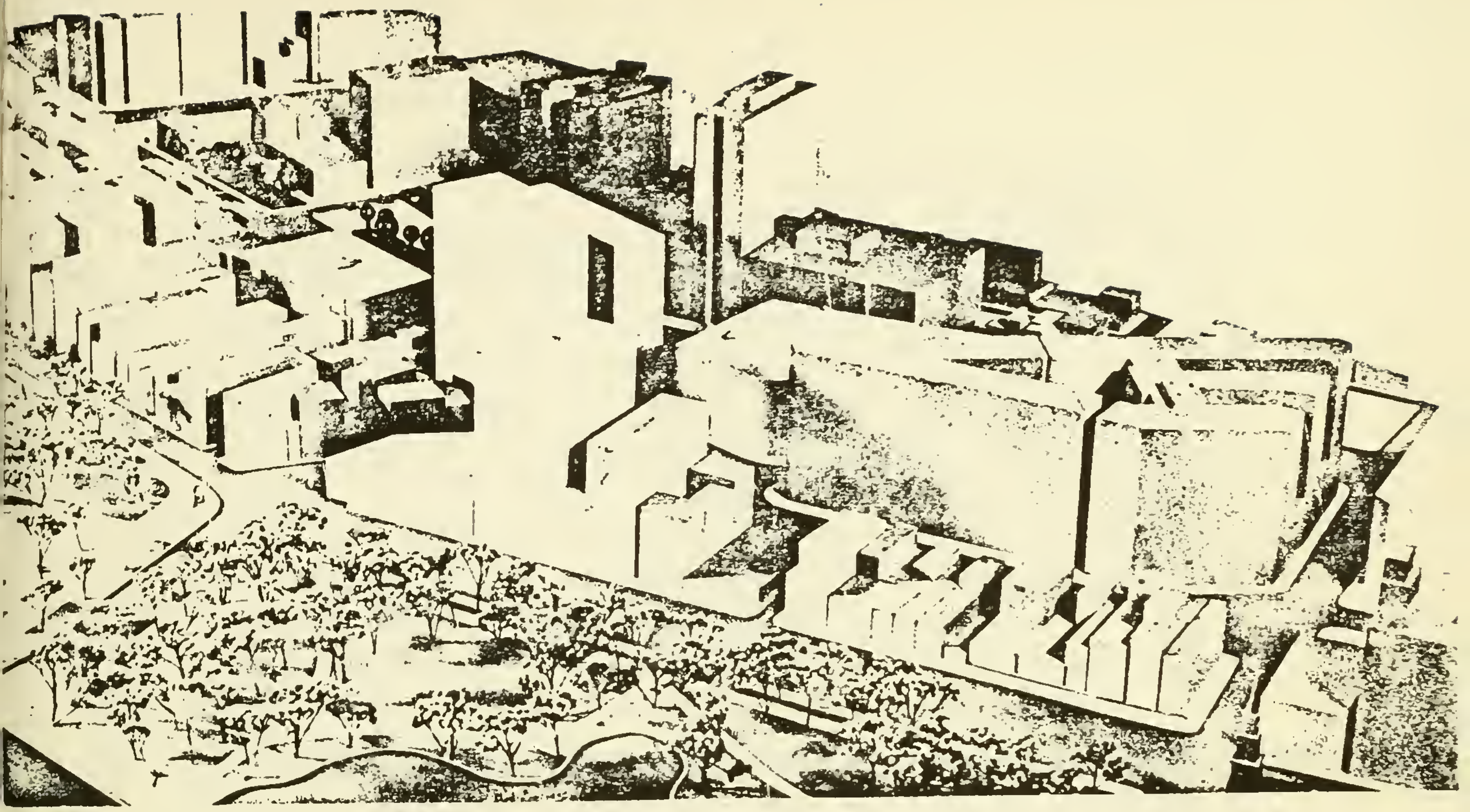
TWO MILLION SQUARE FEET

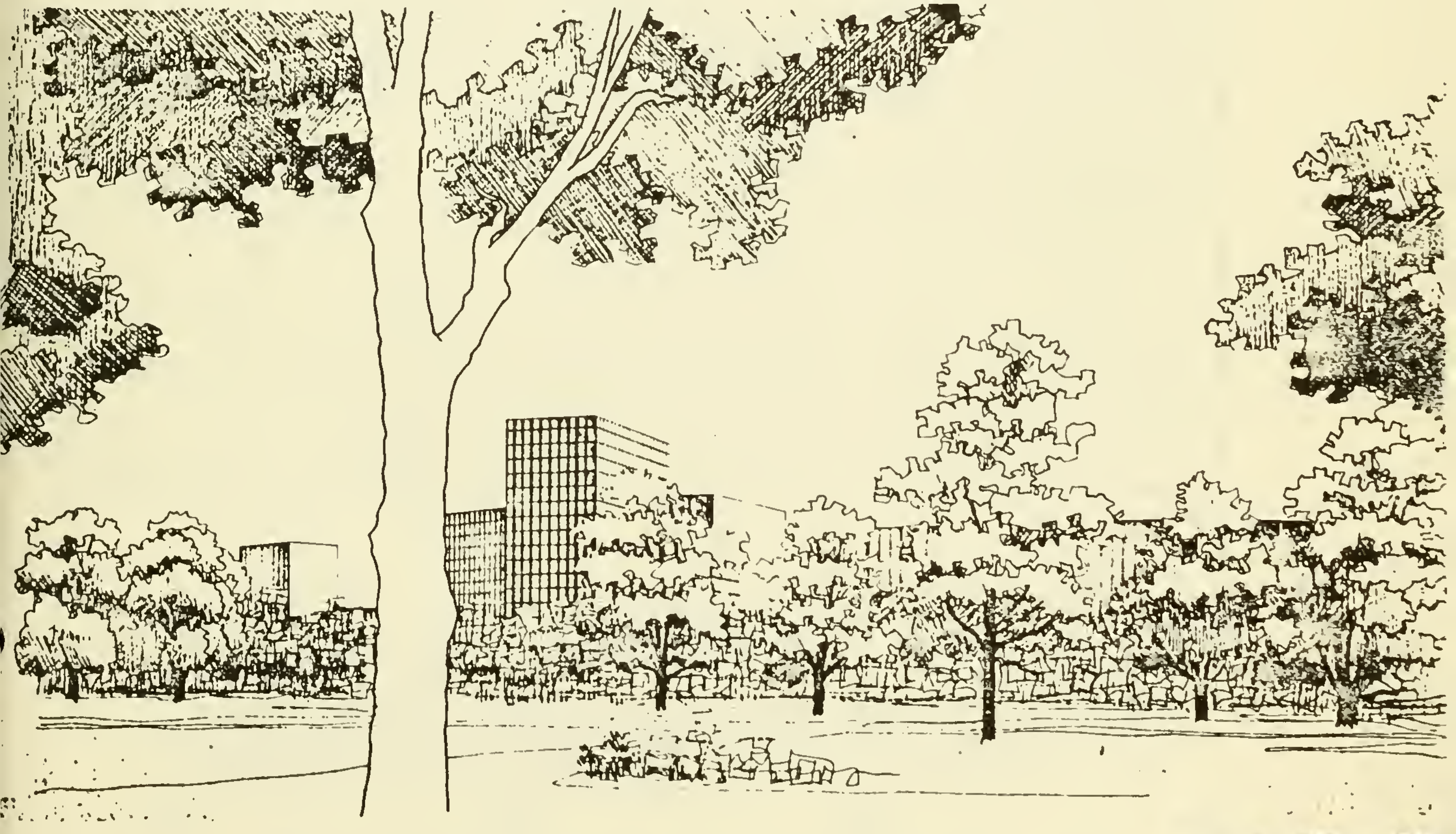
	FUNCTION	SQUARE FOOTAGE	FLOORS	TOTAL HEIGHT
1	Retail	4,000	1 Flr (1)	
	Office	54,000	9 Flrs (2-10)	125'
2	Retail	9,000	1 Flr (1)	
	Office	246,500	17 Flrs (2-18)	225'
3	Retail	13,000	1 Flr (1)	
	Office	51,000	3 Flrs (2-4)	50'
4	Retail	9,000	1 Flr (1)	
	Apartments	212,500	17 Flrs (2-18)	185'
5	Retail	10,000	1 Flr (1)	
	Apartments	195,000	15 Flrs (2-16)	165'



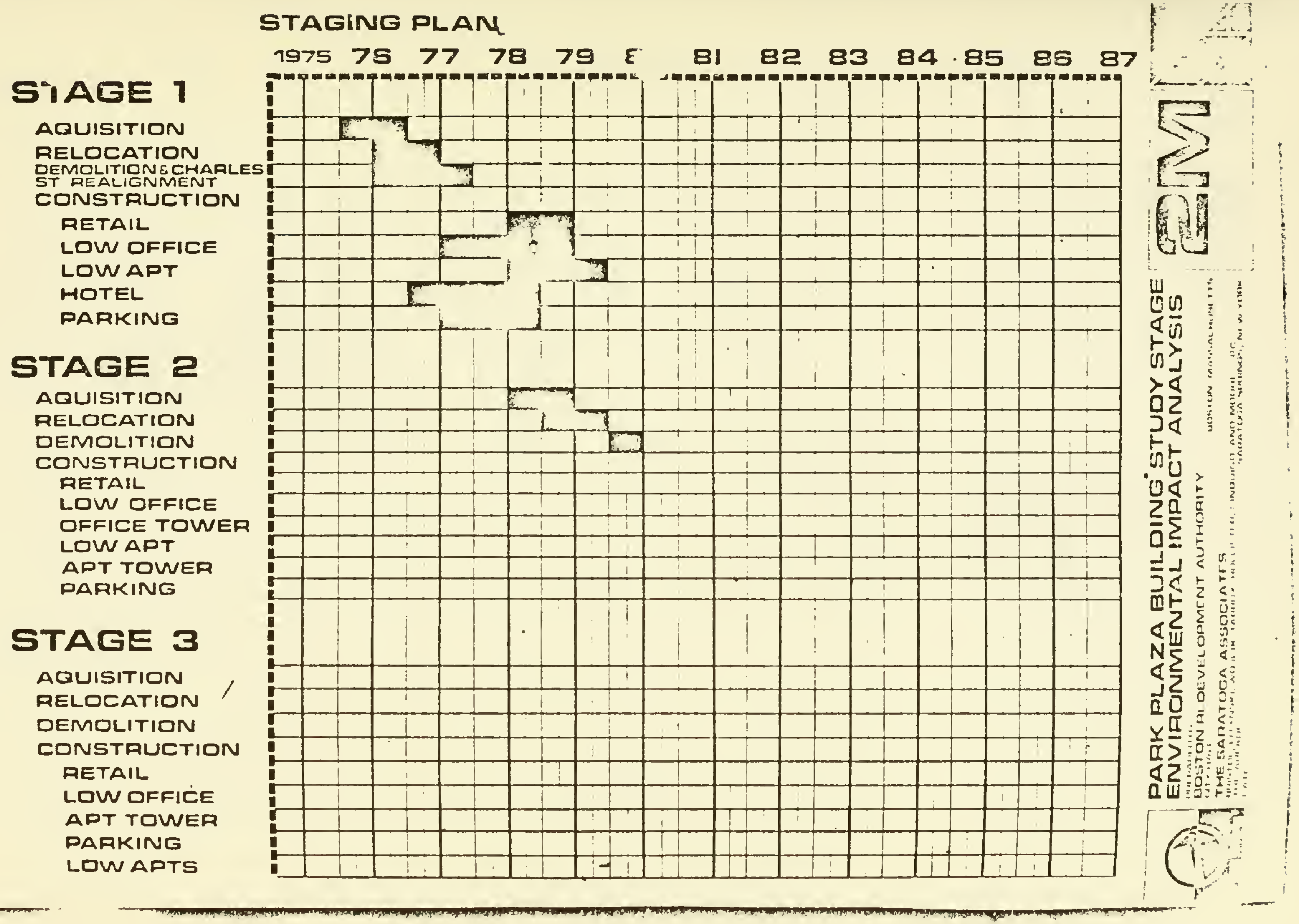


VIEW FROM PARK ST CHURCH





VIEW FROM BEACON & ARLINGTON ST


STAGING PLAN
1975
76
77
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8
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86
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STAGE 1
AQUISITION
RELOCATION
DEMOLITION & CHARLES ST REALIGNMENT
CONSTRUCTION
RETAIL
LOW OFFICE
LOW APT
HOTEL
PARKING
STAGE 2
AQUISITION
RELOCATION
DEMOLITION
CONSTRUCTION
RETAIL
LOW OFFICE
OFFICE TOWER
LOW APT
APT TOWER
PARKING
STAGE 3
AQUISITION
RELOCATION
DEMOLITION
CONSTRUCTION
RETAIL
LOW OFFICE
APT TOWER
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LOW APTS
PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON RE DEVELOPMENT AUTHORITY
THE SARATOGA ASSOCIATES
BOSTON MASSACHUSETTS
SARATOGA SPRINGS, NEW YORK

IMPACT GENERATORS

The predescribed alternatives have been translated into actions affecting the environment (Impact Generators) as are necessary to correlate with The Environmental Base characteristics (Chapter IV) for Testing and Evaluation (Chapter VI).

The balance of this Development Program Interpretation Chapter is devoted to the articulation of the Impact Generators and is organized to correspond with The Environmental Base as follows:

Natural Physical

1 Land Form
2 Bedrock Geology
3 Surficial Geomorphology
4 Air Resources
5 Climate
6 Surficial Hydrology
7 Subsurface Hydrology
8 Vegetative Resources
9 Faunal Resources

Built Physical

10. Perceptual Environment
11. Land Use

12. Built Character

13. Circulation

14. Utilities

Social-Political

15. Demographic Structure

16. Group Structure

17. Political Structure

18. Functional Services

Economic

19. Public Economic Structure

20. Private Economic Structure

INFORMATION CONTAINED IN THIS SECTION IS PRIMARILY FIRST ORDER, DIRECT IMPACTS. IN SOME CASES, SIGNIFICANT INDIRECT IMPACTS, SUCH AS SHADOW DISTRIBUTION, ARE ALSO INCLUDED. ALL OTHER IMPACTS ARE DESCRIBED IN CHAPTER 6 - TESTING AND EVALUATION.

LAND FORM

For a description of any significant environmental impacts, refer to Chapter 6-Testing and Evaluation.

BEDROCK GEOLOGY

This section also includes
actions affecting
Subsurface Geomorphology

BEDROCK GEOLOGY[1]

The development schemes include up to five high rise towers, three of which would be of the order of 40 stories and two of which would be of the order of 25 stories. The balance of the area to be occupied by medium rise buildings of the order of 15 stories and low rise buildings of the order of eight to ten stories.

Also considered are five conditions with respect to basement areas.

- Condition 1 includes only minimum required mechanical space below each building (assumed to be 80 feet square).
- Condition 2 assumes a single level of basement below each building.
- Condition 3 assumes a single level below grade over the entire area.
- Condition 4 assumes two basement levels beneath each building.
- Condition 5 assumes two levels below grade over the entire area.

It is further assumed that all below grade space would be linked by service tunnels capable of accommodating truck

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* Golder, Gass Associates, Inc., A. Allen Gass, 1975

traffic.

Foundation design in the area depends on a variety of factors including number of stories, structural systems and subsurface conditions. From the point of view of subsurface conditions in the area west of Carver Street the fill and organic materials are incompetent for foundations and structural loads must be taken at least to the dense sand and gravels where present or into the interbedded sand/clay complex. Depending on accessibility from the surface, the foundation systems employed might be spread footings, short compacted concrete piles to the sand and gravel where present, drilled piers to the surface of the sand/clay complex or friction piles driven into the sand/clay complex. East of Carver Street the sand/clay complex is easily accessible and spread footings would probably be the most satisfactory system to the limits discussed below.

The sand/clay complex is competent up to limits which are not easily defined. These limits are imposed principally by the strength and compressibility of the clay portions of the stratum. The consistency or strength of the clay is good, being generally very stiff to stiff. However, as concentrated building loads increase (for example from columns) a point is reached at which it is simply not possible or not practical to utilize the sand/clay complex because of its limited

strength. This point may be reached in a fairly high office building with a light structural system and close column spacings or it may be reached in a fairly low building such as a heavy reinforced concrete garage structure with relatively large spans. Similarly, although the clay portions are probably at least lightly overconsolidated throughout most of the depth of the stratum, a point is reached at which the net weight of a building (gross weight less the weight of soil excavated for basements) would induce intolerable settlements due to compression of the clay even though individual concentrated loads might be safely carried.

When either of these points are reached the sand/clay complex must be by-passed by deep piles of piers extending into the more competent glacial till or bedrock. It should be noted that the net load of a building can be adjusted by varying the number of basement levels to achieve in effect "flotation" of the structure in which case a concrete mat foundation bearing in the sand/clay complex might be substituted for deep piles or piers. Technically either system would be satisfactory and the choice depends chiefly on economics.

In general it is considered that buildings up to 15 stories with a single basement could probably be constructed directly on spread footings in the eastern third of the site and on

short piers or piles in the area west of Carver Street. This conclusion is based on the fact that buildings up to this size and utilizing these foundation systems have been built in the area and performed successfully. It also assumes conventional office or apartment structures with regular column layouts and relatively short spans. Very heavy structures, those with irregular layouts or those with long spans which generate heavy concentrated loads might require deep piles depending on the particular design and the detailed subsurface conditions as discussed above.

Buildings of the order of 25 stories would everywhere probably require deep piles or piers to the very dense glacial till or bedrock, although if two basement levels below grade were specified (Conditions 4 and 5) a foundation mat bearing directly on the subgrade might prove to be technically feasible and more economical. The only options available for buildings greater than 25 stories would be deep piles or piers. For all cases technically feasible foundation systems are available and, although premium foundation costs would be involved for all structures except those founded on spread footings, it is unlikely that these costs would be large enough to have an overriding impact on the economic feasibility of the development.

For a single level of construction below grade (Conditions 1, 2 and 3) no serious design problems would be involved. Depending on the exact levels of groundwater in the fill west of Carver Street basement,floors and foundation caps could extend just into the water. This would involve small premium costs which would be more of an annoyance than a large economic factor. There would probably, however, be a tendency on the part of both designer and contractor to raise the general platform level of the project by the few feet necessary to clear the water, thus avoiding the problem. Service tunnels and some mechanical areas might require greater vertical clearance in which case the problem would be more severe, but still not excessive.

With two levels of construction below grade (Conditions 4 and 5), there is no doubt that at least the lower level would be below groundwater everywhere on the site. Heavy construction to resist water pressures and waterproofing would therefore be required. Again, premium costs would be involved which in this case would be severe enough to warrant analysis of their overall economic impact. Offsetting factors also may be involved and would require consideration. For example, in the area west of Carver Street two levels below grade might permit the elimination of deep foundation piles for buildings of the

order of 25 stories in height. Similarly, in the eastern third of the site the possibility of eliminating water pressures by the use of relatively inexpensive drainage systems could be considered.

It should be noted that design of all areas below groundwater levels should be based on the criterion that water levels beneath adjacent property cannot be adversely affected. Careful investigation and analysis would be required to ensure that this criterion is met. Technically there is no reason to expect that it could not be met.

The question of what effects development might have on neighboring property due to geotechnical factors is extremely complex, principally because the answer depends not only on design, but execution. However, the technology and the experience exist to make such effects negligible. In order to ensure this a thorough investigation and analysis of soil and groundwater conditions at and around the site would have to be made, the design would have to adhere faithfully to the results of the investigation and analysis and, finally, strict control would have to be exercised over construction procedures. The principal consideration with respect to

design is that it have no permanent adverse effects on groundwater levels, particularly west of Carver Street. In this area many of the older buildings are probably founded on wood piles. Permanent or prolonged lowering of the groundwater could result in rotting of any timber piles exposed to air and, consequently, severe damage to structures. Therefore, it should be a design requirement that no adverse change in the groundwater levels established by the investigation be permitted. This would mean that any portion of the development extending below groundwater levels would have to be designed as a waterproof box.

Similarly, in the case of construction it should be specified that excavations and control of groundwater be carried out in a manner to avoid adverse changes in groundwater levels and a monitoring system should be set up to ensure that this specification is met. It is practically impossible to excavate below groundwater levels without causing some measurable change in surrounding water levels, and it is not necessarily true that changes in water levels automatically result in damage to surrounding property. Therefore, an "adverse change" in groundwater levels would be defined as a change likely to cause damage to surrounding property. More precise definition of this term would depend on the results of the investigation

and analysis specified above.

It should also be specified that excavation, control of groundwater and installation of foundations be carried out by procedures which do not permit disturbance or loss of soil. Adequate support of excavations and protection of property adjacent to excavations should also be specified. These are fairly standard requirements in most contracts and no special difficulties in meeting them at this site are anticipated. However, the meeting of these requirements depends absolutely on the procedures employed in the field and it is for this reason that strict control over construction would be essential.

SURFICIAL GEOMORPHOLOGY

For a description of any significant impacts, refer to Chapter 6 - Testing and Evaluation.

AIR RESOURCES

AIR QUALITY [1]

Analysis

The objective of this preliminary assessment was to rank and evaluate the relative impacts on community air quality of the various project design alternatives, including the no-build alternative. The impact of Park Plaza on community air quality levels can come from two principal types of sources: emissions associated with space heating and cooling requirements and emissions from induced motor vehicle traffic. This latter source was the object of the current analysis and for the purposes of this study was used as an indicator of the relative impacts of the various design alternatives.

The assessments of the impact on air quality of motor vehicle traffic associated with a proposed redevelopment project can be based on a comparison of projected carbon monoxide (CO) concentrations within the project area for the project no-build and build alternatives. Although motor vehicles are also major contributors to nitrogen oxide and reactive hydrocarbon emissions in the community, these contaminants participate in a series of complex photochemical reactions for which current atmospheric diffusion modeling technology does

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[1] Walden Assoc., 1975

not permit preparation of reliable estimates of projected concentration levels. However, CO is relatively inert and can be predicted using current modeling techniques. In addition, CO is the pollutant emitted in the largest quantities from automotive sources.

For the purpose of this analysis, the maximum one-hour and eight-hour CO levels which could arise as a consequence of both adverse meteorological conditions and peak roadway traffic (the "worst-worst" case) were evaluated for the no-build case and for four build alternatives.

No background concentrations were included in predicted CO levels, nor was the atmospheric diffusion model used validated or calibrated with local field measurements. Its intended purpose is the determination of the relative impacts of several program alternatives on local CO concentrations.

Predicted Carbon Monoxide Concentrations at Selected Receptor Locations

Detailed modeling simulations were conducted for the project

no-build and build alternatives at seven sensitive receptor locations covering the perimeter of the Park Plaza Project. The receptor locations were selected to correspond to points where maximum public exposure to high levels of CO emissions from project area roadways are expected to occur. These receptor locations are:

1. Public Garden (along Boylston Street)
2. Charles Street (near Boylston Street)
3. Boston Common (along Boylston Street)
4. Theater District (along Tremont Street)
5: Stuart Street (near Tremont Street)
6. Howard Johnson's 57 Hotel (along Stuart Street)
7. Statler Hilton Hotel (along Arlington Street)

ESTIMATED MOTOR VEHICLE EMISSION RATES FOR CARBON MONOXIDE IN BOSTON

Average Vehicle Speed (mph)	CO Emissions (grams/mile) 1975	1985
15	61.0	17.3
20	48.5	14.2

PREDICTED MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS* AT SELECTED RECEPTOR LOCATIONS (IN PPM)

Receptor Site	Future (1985) Alternatives				
	No-Build	3M**	4M	5M	6M
1. Public Garden	2.2	2.2	2.2	2.2	2.2
2. Charles Street	1.4	1.5	1.6	1.7	1.7
3. Boston Common	1.5	1.5	1.5	1.5	1.5
4. Theater District	1.5	1.5	1.5	1.5	1.5
5. Stuart Street	2.0	2.1	2.3	2.6	2.6
6. Howard Johnson's 57 Hotel	1.0	1.2	1.5	1.9	1.9
7. Statler Hilton Hotel	1.5	1.6	1.6	1.6	1.6

* Does not include background levels.

** Cases identified by M are the build alternatives. Numbers refer to the millions of square feet of building area associated with each build option.

PREDICTED MAXIMUM 8-HOUR CARBON MONOXIDE CONCENTRATIONS* AT SELECTED RECEPTOR LOCATIONS (IN PPM)

Receptor Site	Future (1985) Alternatives				
	No-Build	3M**	4M	5M	6M
1. Public Garden	1.5	1.5	1.5	1.5	1.5
2. Charles Street	0.9	1.0	1.0	1.1	1.1
3. Boston Common	1.1	1.1	1.1	1.1	1.1
4. Theater District	1.0	1.0	1.0	1.0	1.0
5. Stuart Street	1.4	1.5	1.6	1.8	1.8
6. Howard Johnson's 57 Hotel	0.8	0.9	1.1	1.4	1.4
7. Statler Hilton Hotel	0.9	0.9	0.9	0.9	0.9

* Does not include background levels.

** Cases identified by M are the build alternatives. Numbers refer to the millions of square feet of building area associated with each build option.

CLIMATE

- Wind
- Solar Exposure

WIND [1]

This section of the report presents the results of a wind tunnel study of pedestrian level wind effects at locations near the proposed Park Plaza redevelopment project in Boston, Massachusetts. Velocity measurements were made at fourteen locations on a wind tunnel model for fourteen locations with a model of the maximum density development envisaged for the area.

The fourteen test locations were selected:

(1) in anticipation of areas most likely to incur high levels of wind activity,

(2) areas subject to heavy pedestrian usage,

(3) areas on the Garden and Common most likely to be affected by the project.

The test locations were in general outside the project site, to define the impact of the development on the area. No tests were made on wind levels within the site area, and it is anticipated that these will be carried out when the project planning has evolved to a more specific design.

Test Data

The test locations are identified in the schematic map in

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[1] Mt. Auburn Associates, 1975

Figure 3. The data is presented for each location in terms of percent occurrence frequencies for various wind speed ranges. For example 20% frequency in the 10-20 mph range indicates that wind speeds will be between 10 and 20 mph on an average of 20% of the time or about six days per month. On Tables 2 and 3 subscript "1" refers to present-day site, and subscript "2" refers to the site after the proposed 6-million square-foot development as indicated on Figure 3. The symbol "+" means a small probability, smaller than 0.1% but greater than zero.

Effect of the Height of the Arlington/Boylston Street Tower

The most severe wind conditions at the project were encountered close to the Arlington/Boylston Street tower buildings. For the development modeled in this study, westerly winds striking the tower building are deflected downward onto Arlington and Boylston Streets. The escape paths around the northwest and southwest corners of the building contribute to the wind conditions at locations H and N.

Additional tests were carried out to examine the sensitivity of wind speeds in the area to the height of the tower. At each of locations N, I, J and B, measurements were made for

the wind direction which had produced the largest acceleration factor in the primary test program. With the tower model now segmented, acceleration factors were measured for the original tower height (450 feet) and for successive 100-foot reductions in height. The results are shown in Table 4.

Care must be exercised in assessing the data in Table 4. It does illustrate that ground level wind speeds are dependent on the building height. However, for different wind directions the "effective height" of the tower, i.e., its height relative to the average height of the buildings upwind, will be different and so the impact on ground level winds will vary. As a generalization, Table 4 shows that the taller the tower, the faster will be the ground level winds. However, a full analysis of the effect of a reduction in the tower height will require testing around the 16 compass points used in the primary study reported here.

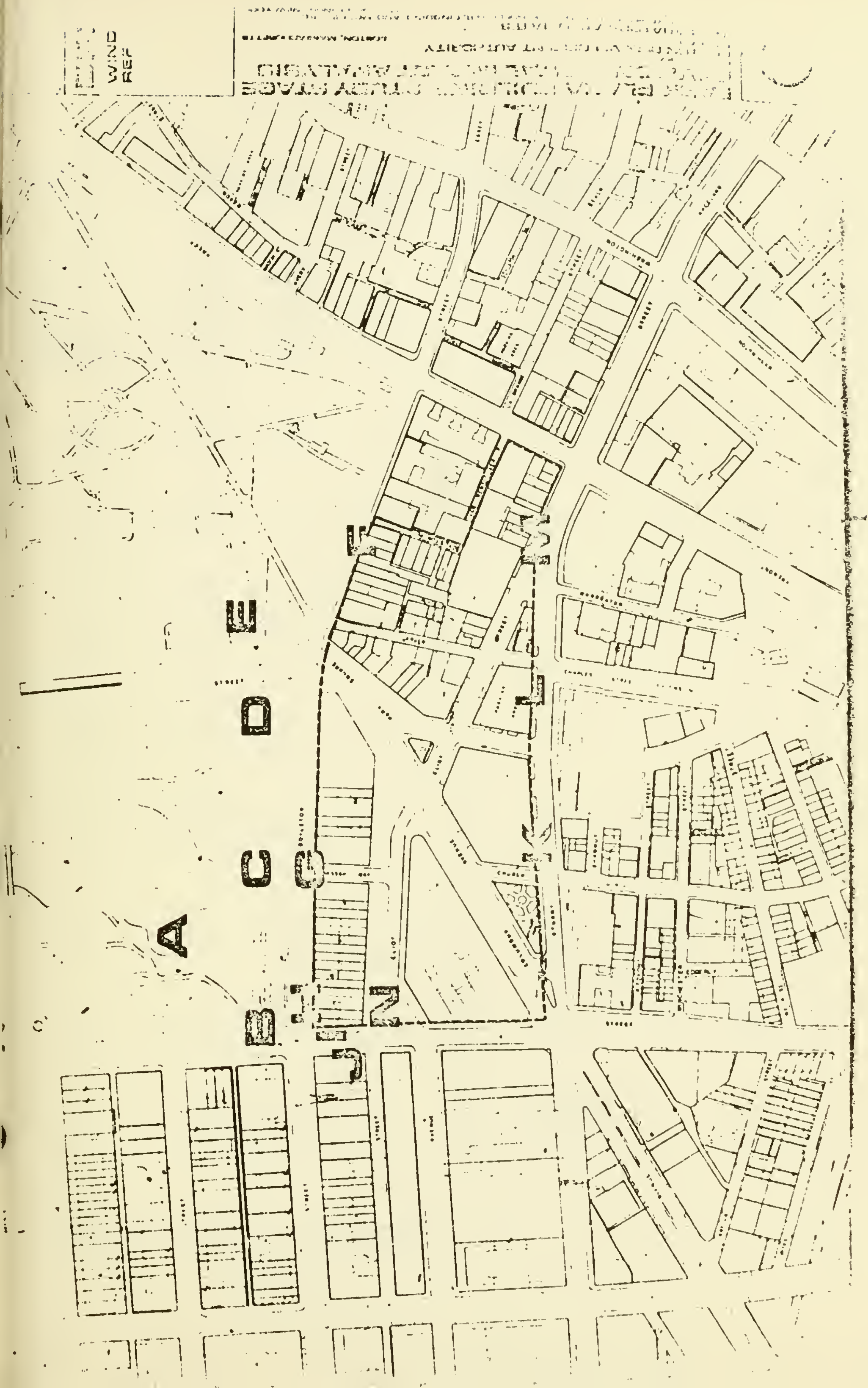
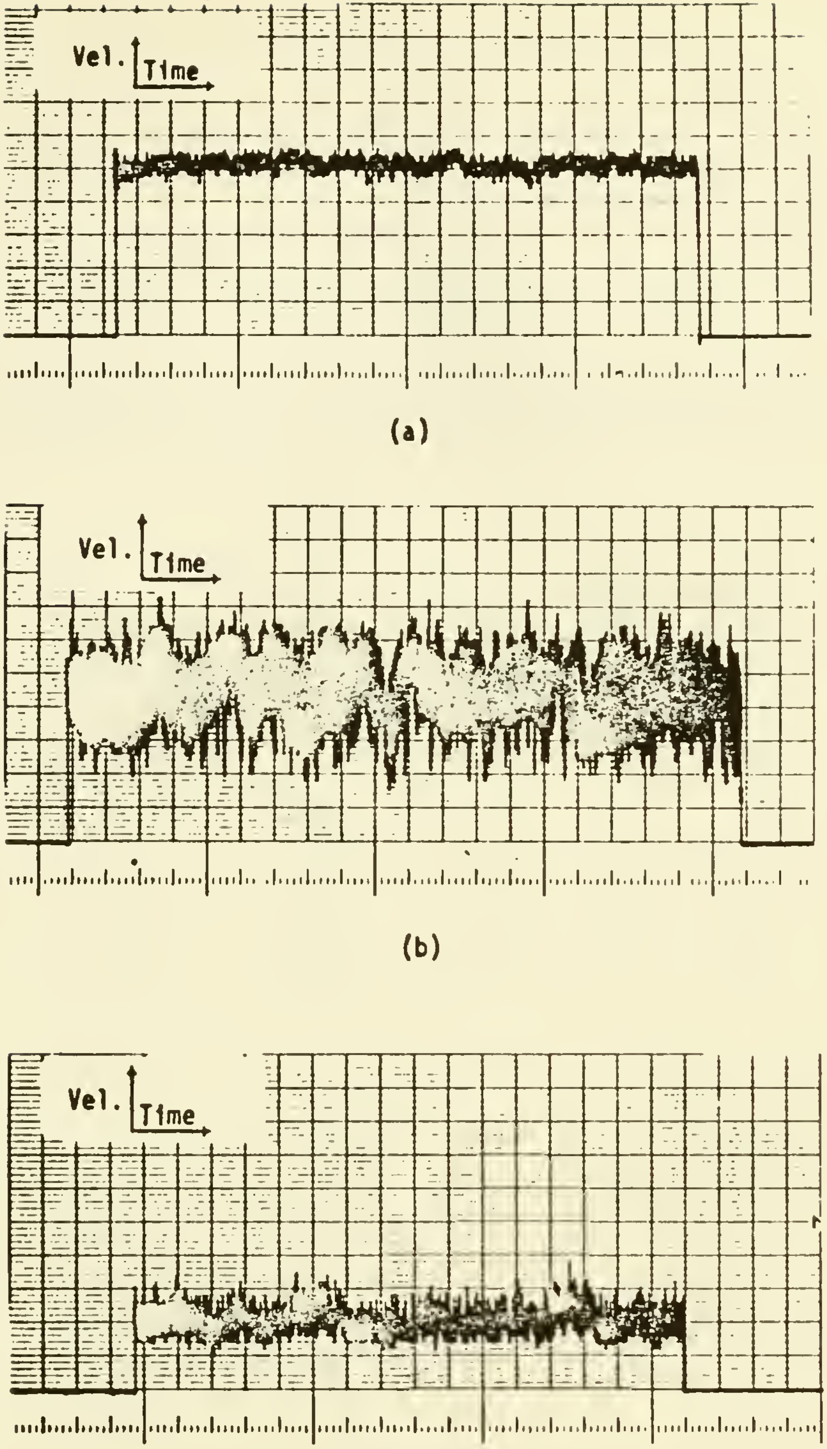

AUTHORITY
BOSTON, MASSACHUSETTS
WIND
REF
A
B
C
D
E

TABLE 2

DATA SUMMARY OF PERCENT OCCURRENCE FREQUENCIES FOR WIND SPEED RANGES 0-10, 10-20, AND >20 mph

	mph				mph		
Location	0-10 (%)	10-20 (%)	> 20 (%)	Location	0-10 (%)	10-20 (%)	> 20 (%)
A_2	58.2	35.5	6.2	I_2	56.5	30.3	13.2
B_2	53.9	35.0	11.1	J_2	55.5	31.3	13.2
C_2	69.3	27.3	3.4	K_2	74.7	21.7	3.6
D_2	72.5	23.7	3.8	L_2	57.7	32.5	9.9
E_2	58.5	34.7	6.8	M_2	56.6	37.7	7.7
F_2	68.7	25.2	6.1	N_2	65.0	22.2	12.8
G_2	68.6	24.4	7.0	$(H/I)_2$	42.1	38.4	19.5
H_2	62.1	29.0	8.9	NE corner of Boston Co. Bldg.	54.0	34.9	11.1

Suffix "2" refers to developed site.



(a)

(b)

(c)

FIGURE 4. Comparative turbulence levels at location I in a NNW wind. (All traces to same scales.)

(a) turbulence level at reference height of 500 feet.

(b) turbulence level at location I_2, with 450-foot tower.

(c) turbulence level at location I_2, with tower removed.

TABLE 4

ACCELERATION FACTORS, V/V_{33}, MEASURED AT LOCATIONS N, I, J, AND B FOR VARIOUS HEIGHTS OF THE ARLINGTON/BOYLSTON STREET TOWER

Location	Wind	Tower Height 450'	350'	250'	150'
		Acceleration factor, V/V_{33}			
N	N	2.1	1.8	0.8	0.2
I	NNW	1.7	1.6	1.2	0.7
J	NNE	2.0	2.0	1.9	1.2
B	SSW	1.3	1.2	0.9	0.8

SOLAR EXPOSURE

The shadows cast by the complexes of buildings have been determined from two sets of parameters, one set describing the solar position, and the other describing the buildings size and orientation. The first set of parameters depends on the site location and the time of year for which a shadow analysis is to be performed. The second set depends on the details of the building proposal. When these parameters are determined, the shadow casting problem becomes a problem of trigonometry; the particular triangle is a right triangle whose height is given by the building height and one of whose angles is given by the sun's position.

The position of the sun in the sky for any time of year can be found in a set of astronomical tables called an ephemeris. The position of the sun relative to the cardinal directions and the horizon for any particular observer can be calculated from the tabulated value using theorems of spherical trigonometry. The particular computer program used in this study automates this table look-up and calculation, requiring only that the user specify the site latitude, the day of year, and the time of day.

The Park Plaza alternates were prepared for computer input by digitizing the coordinates of each building on an Auto-

Trol 3700 series digitizer. This process was used to measure the precise plan and height of each building and record the data on punched cards. These cards were then processed into a format suitable for input into the SHADOW and PERSPECTIVE programs. This same process was employed to record data on exisiting street patterns, new street alignments and the pathways in the Public Garden and Boston Common.

Th SHADOW program was run for existing conditions and each alternative for five hours during one day on each of seven months. Since sun paths are symmetrical about June 21 and December 22, plotting the seven months from December through June provided a complete yearly picture. The times of day selected were 8 a.m., 10 a.m., 12 noon, 3 p.m. and 5 p.m. (4 p.m. for December and January since at 5 p.m. in these months the sun is below the horizon).

Percent of Shadow Distribution On A Ground Plane

The percent of time that a segment of ground is in shadow per year is related to the following parameters:

- The number of hours of sunlight that is possible per day.

- The rate of movement of the shadow path in feet per hour. The rate of movement along the length of a shadow from outer edge to base of building is not constant. Since the rate of movement is directly related to the altitude of the sun, this rate varies with latitude and time of year.

- The width of the shadow in feet. This width varies with building geometry becoming thicker and thinner as the sun moves around it.

Graphic Display

- The Boston Common and Public Garden was divided into grid squares of 200 feet on a side.

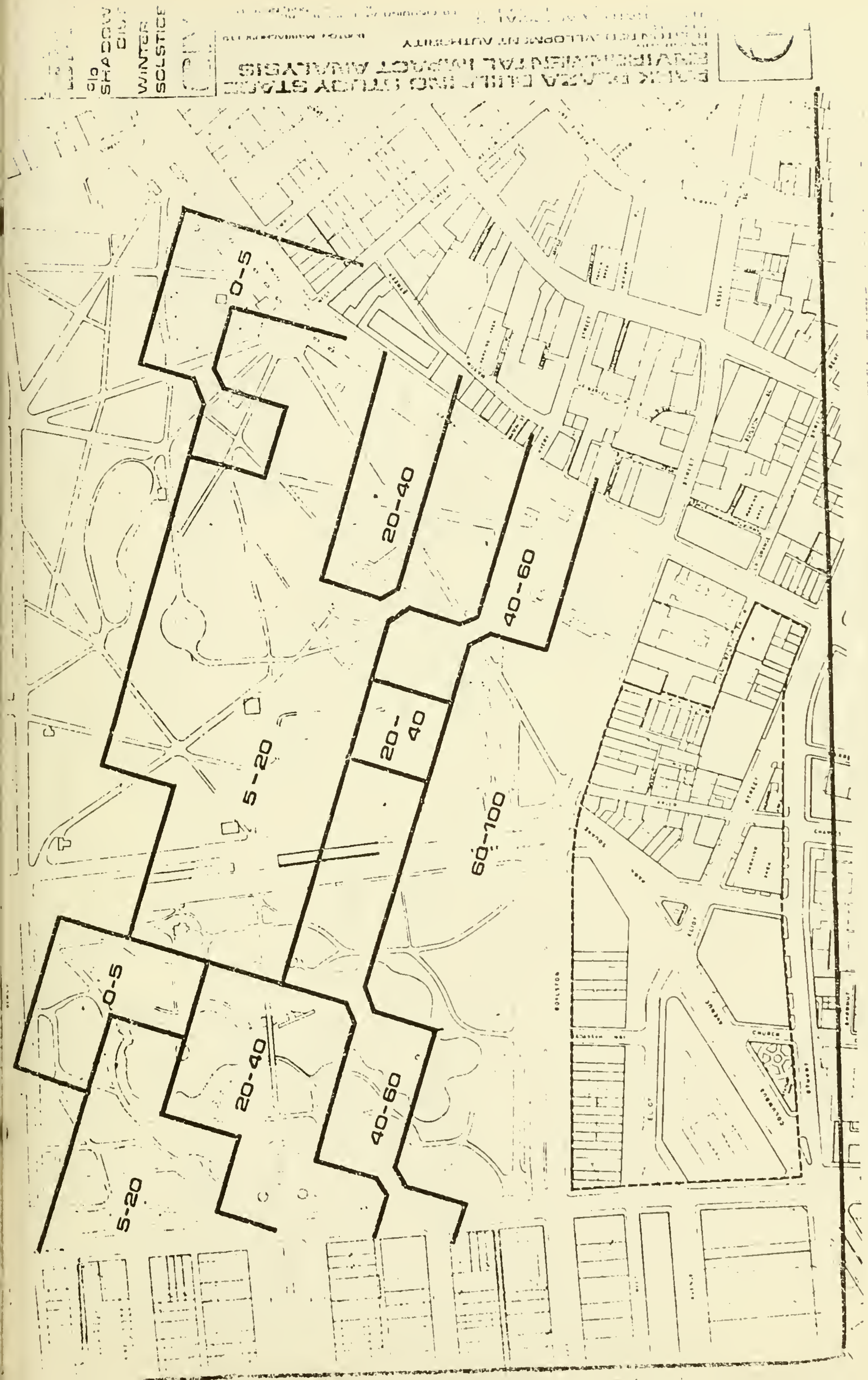
- Shadow outlines were drawn for each building separately for five times during the day. Widths of these shadows were measured across each grid square.

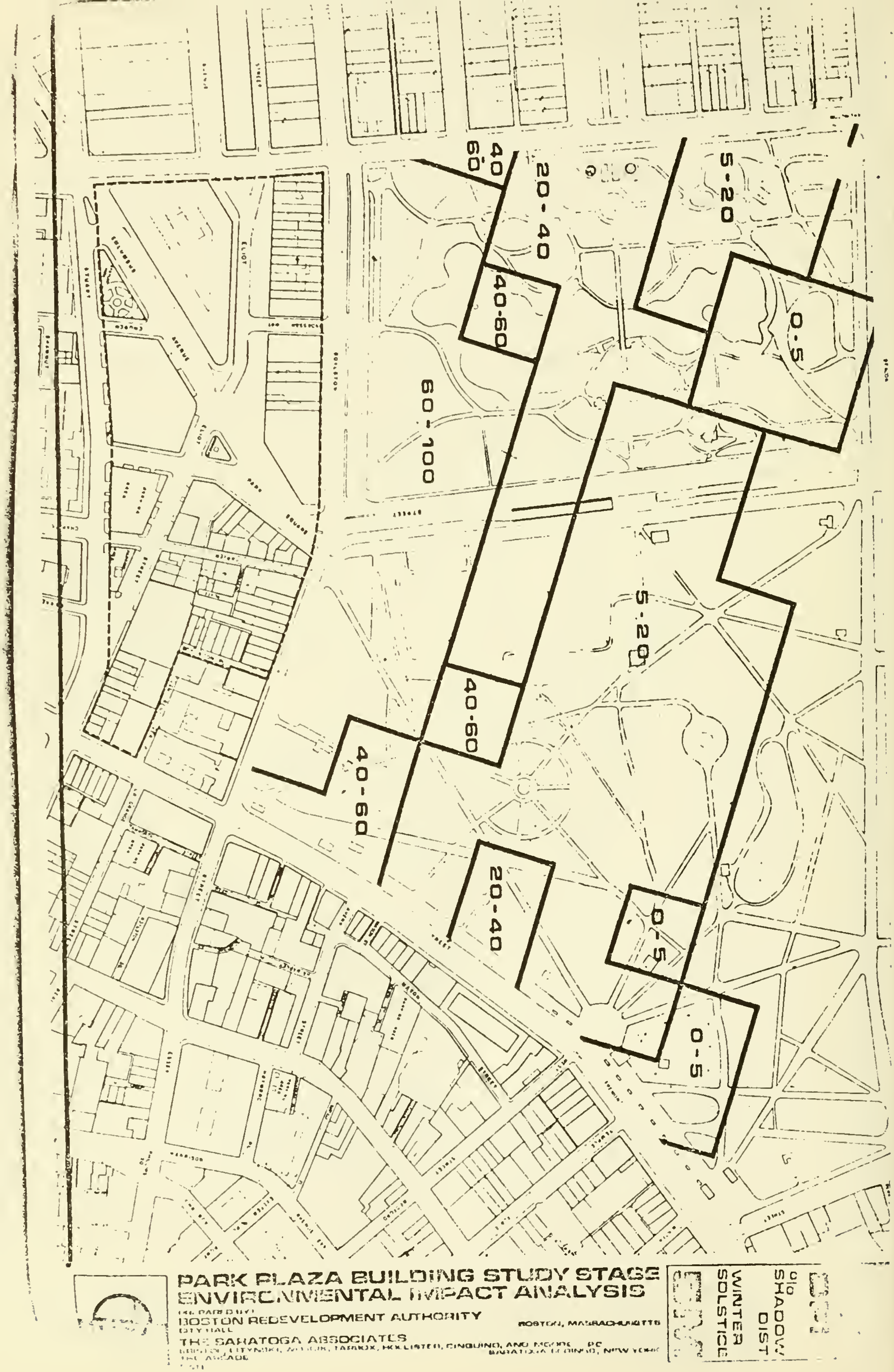
- Rates of movement of shadows crossing each grid were calculated for each building using formula (1).

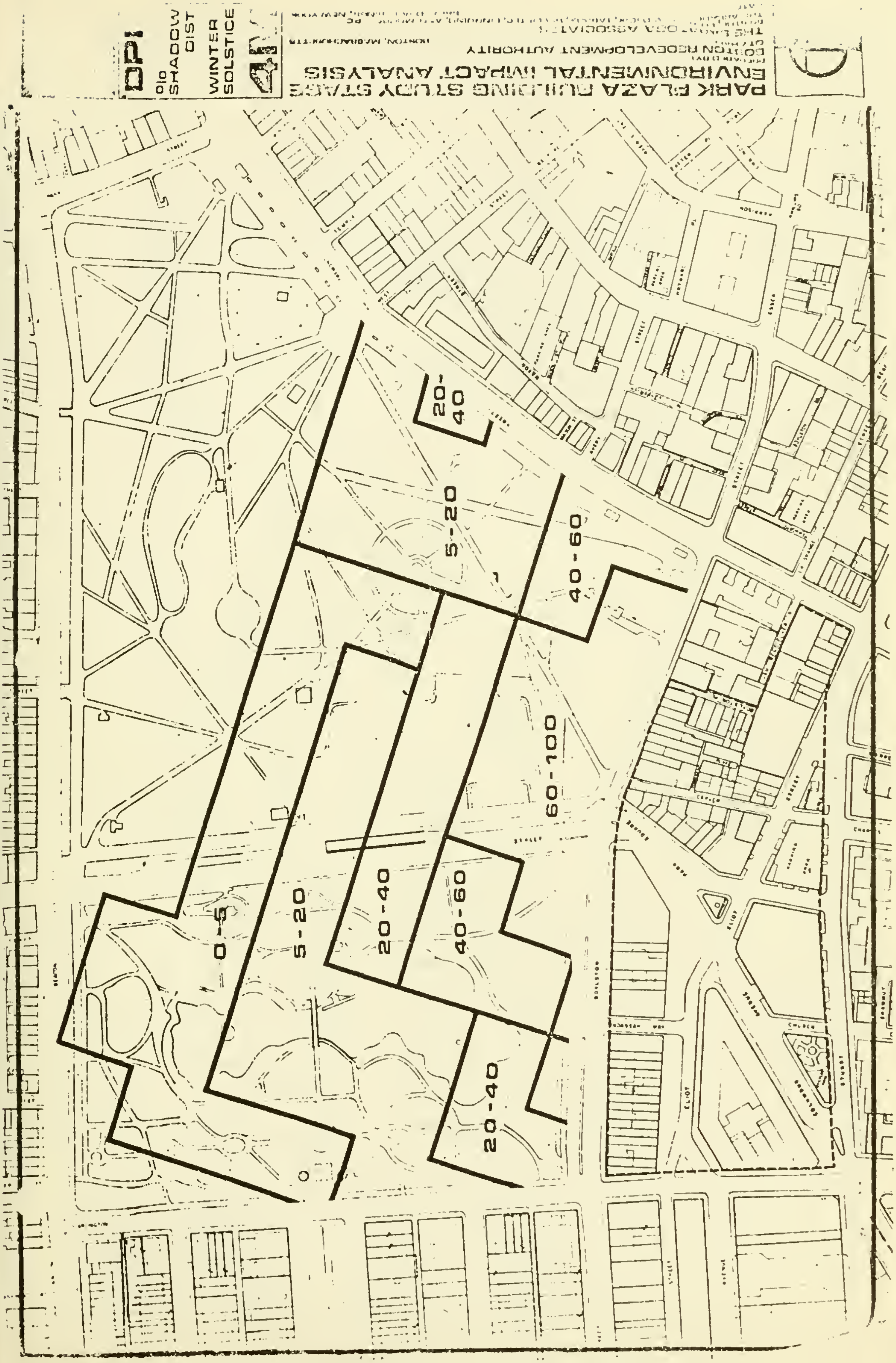
- The percent of time that each ground segment is in shadow for each building was determined.

- Overlap was determined visually and if two or more shadows overlapped during the same time period, the greatest percentage was taken.

- Totals were transferred to the grid squares and contours drawn for these percentages. The final drawing shows these contours overlaid on the Boston Common and Public Garden.


% SHADOW DIST.
WINTER SOLSTICE
0-5
20-40
40-60
20-40
5-20
60-100
0-5
20-40
40-60
5-20


0-5
0-5
0-5
5-20
5-20
20-40
20-40
40-60
40-60
40-60
40
60
60-100
PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
CITY HALL
BOSTON, MASSACHUSETTS
THE SARATOGA ASSOCIATES
SARATOGA SPRINGS, NEW YORK
%
SHADOW DIST
WINTER SOLSTICE
STREET
ELIOT
PARK
BOYLSTON
CHURCH
COLUMBUS
STUART
CHARLES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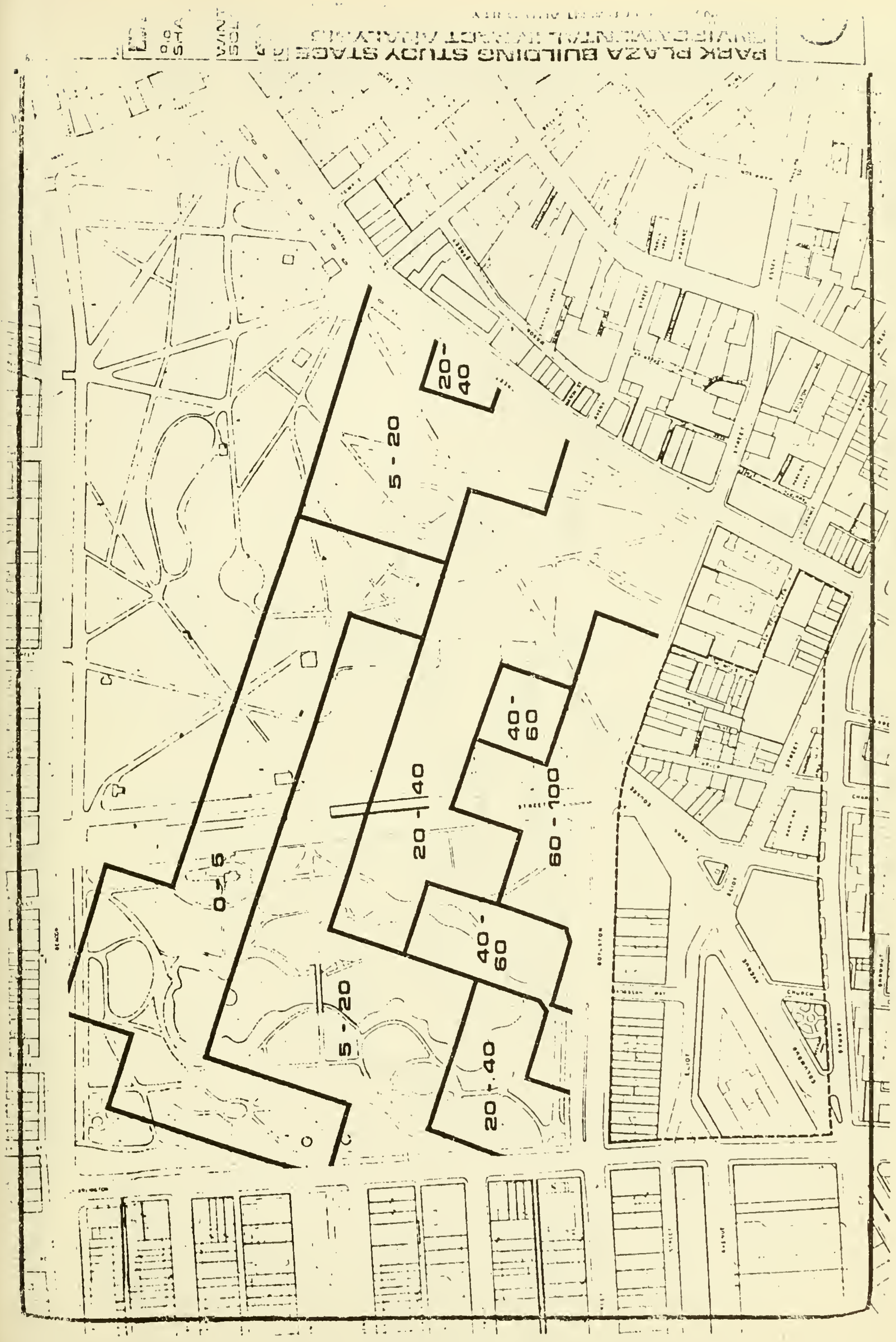
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
BOSTON, MASSACHUSETTS
DPI
% SHADOW DIST
WINTER SOLSTICE
20-40
5-20
40-60
60-100
0-5
5-20
20-40
40-60
20-40
BOYLSTON
ELIOT
CHURCH
PARK SQUARE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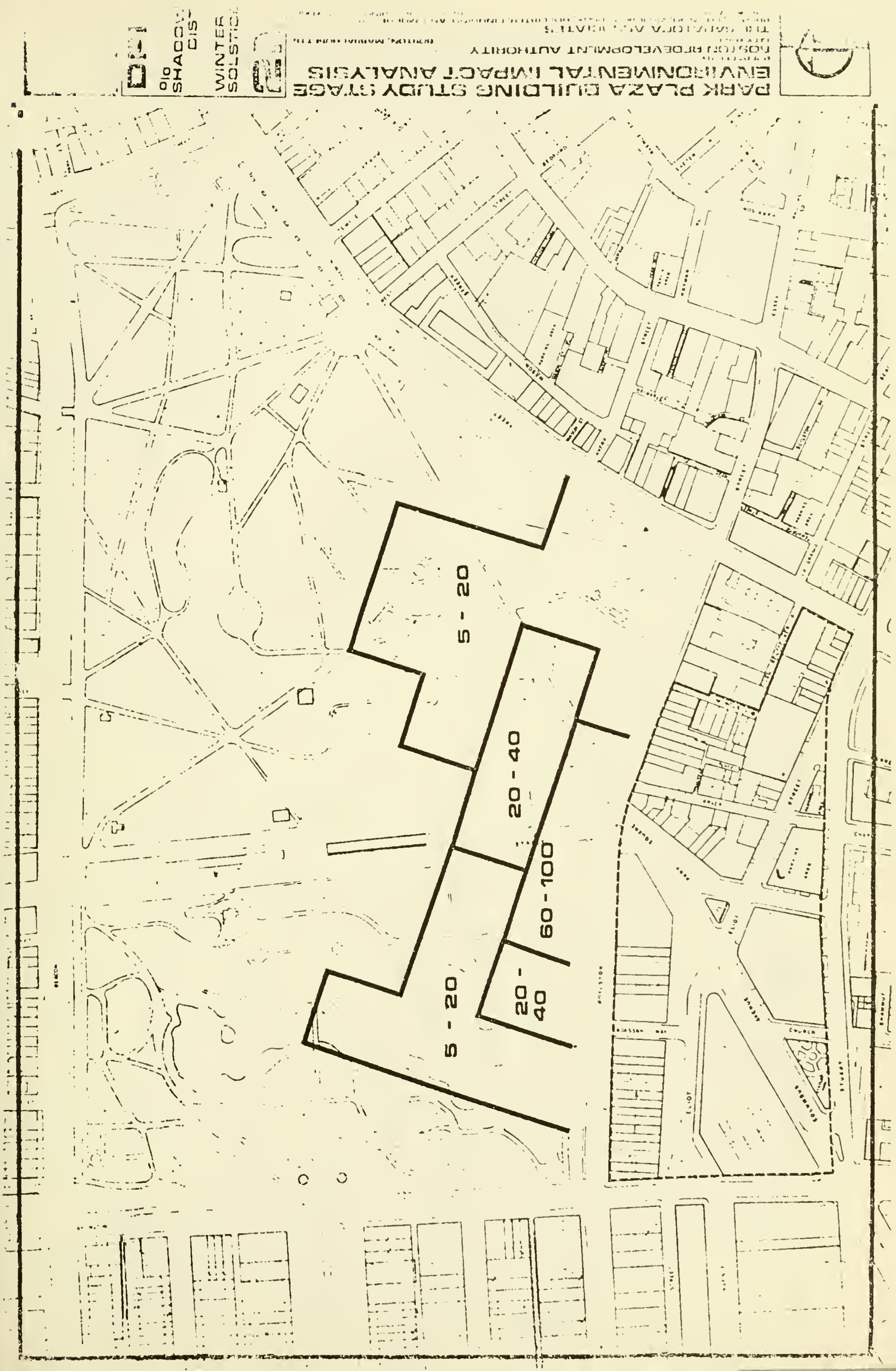
20 - 40
5 - 20
40 - 60
20 - 40
60 - 100
0 - 5
40 - 60
5 - 20
20 - 40
BOYLSTON
CHURCH
ELIOT
COLUMBUS
STREET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ENVIRONMENTAL IMPACT ANALYSIS
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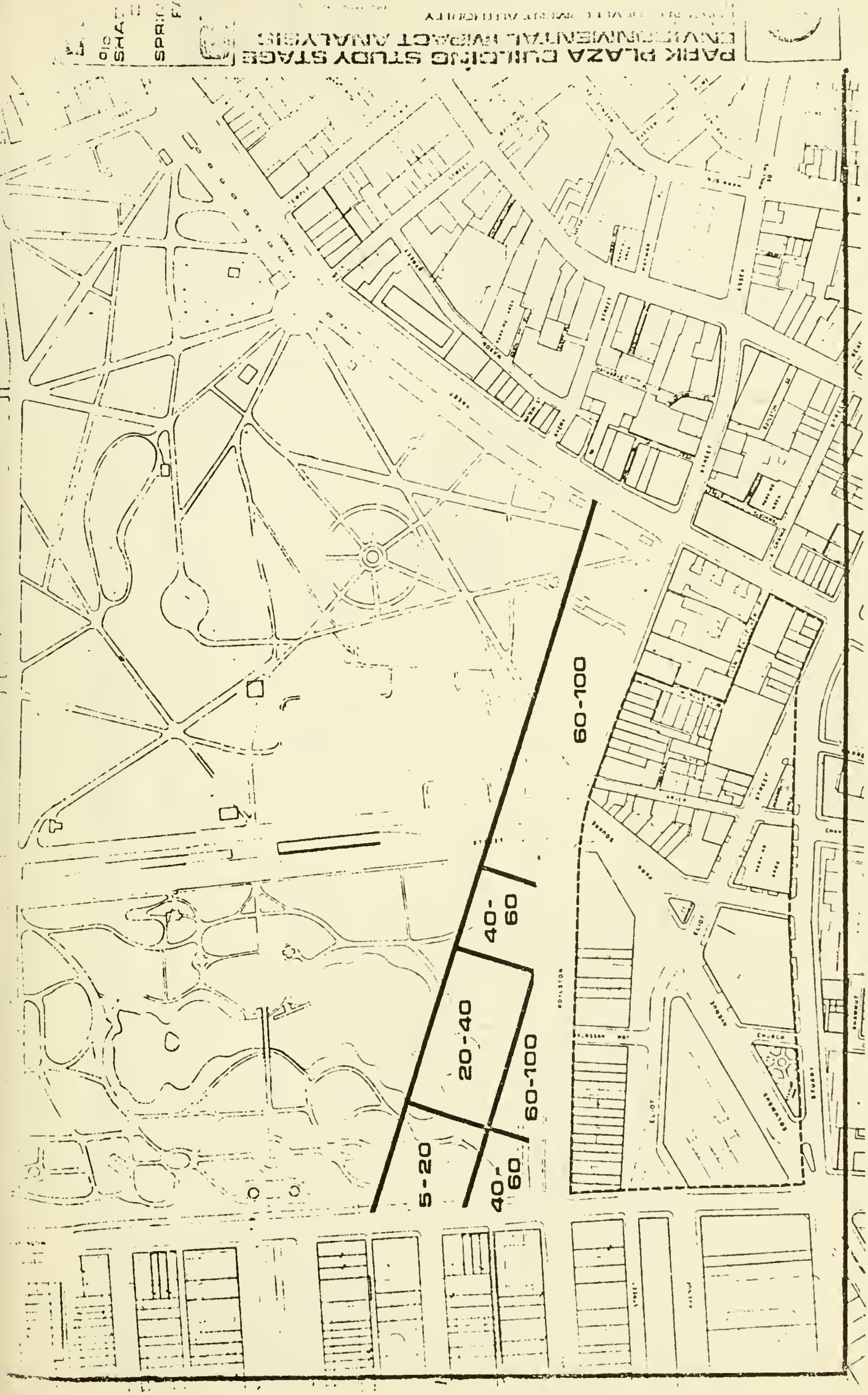
% SHADOW DIST
WINTER SOLSTICE
5 - 20
20 - 40
60 - 100
20 - 40
5 - 20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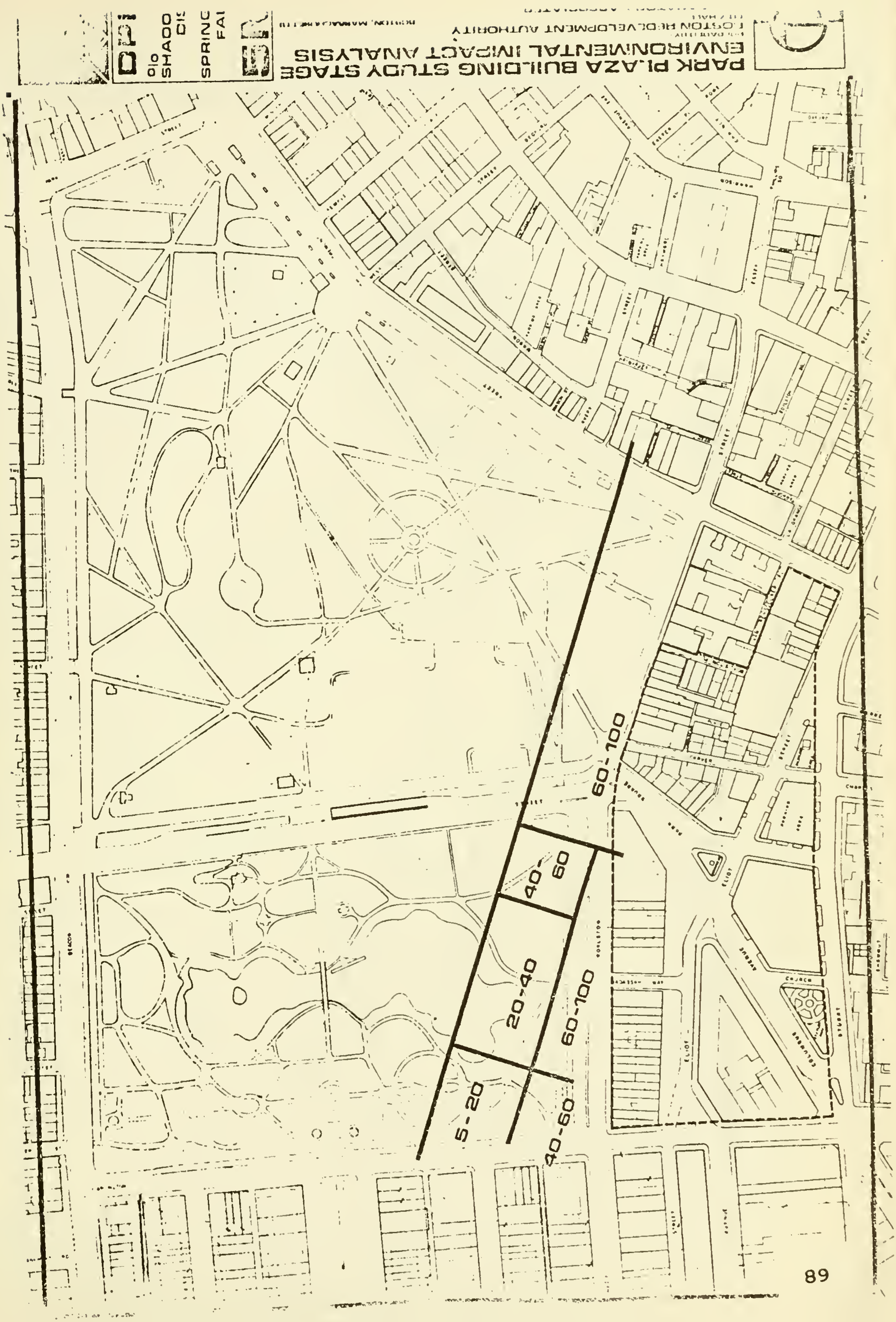
40-60
20-40
60-100
5-20
40-60
BOYLSTON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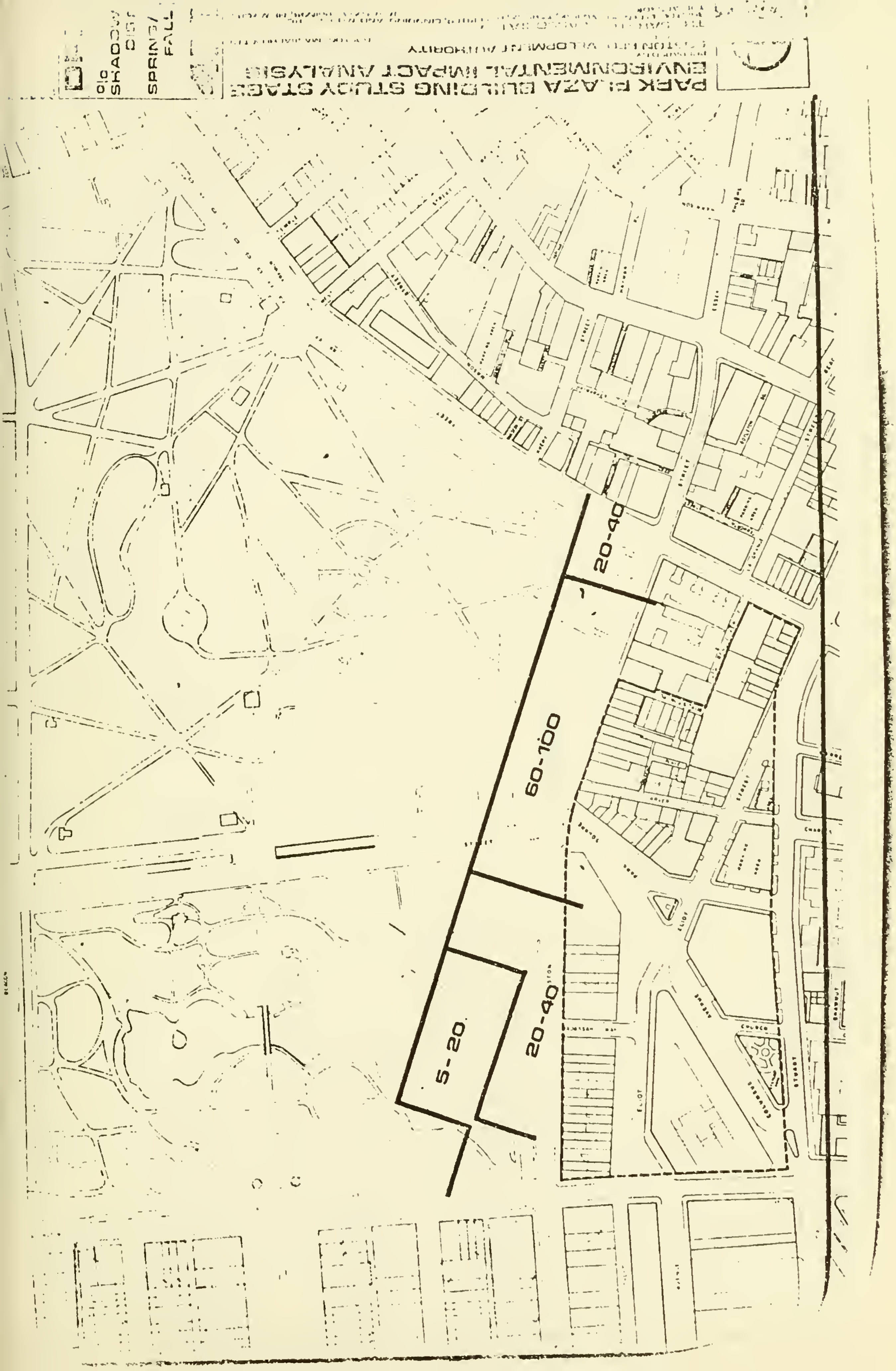
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
CITY HALL
BOSTON, MASSACHUSETTS
SHADO
DI
SPRING
FA
60-100
40-60
20-40
60-100
5-20
40-60
ELIOT
BOYLSTON
CHARLES
BEACON
CHURCH
STUART
COLUMBUS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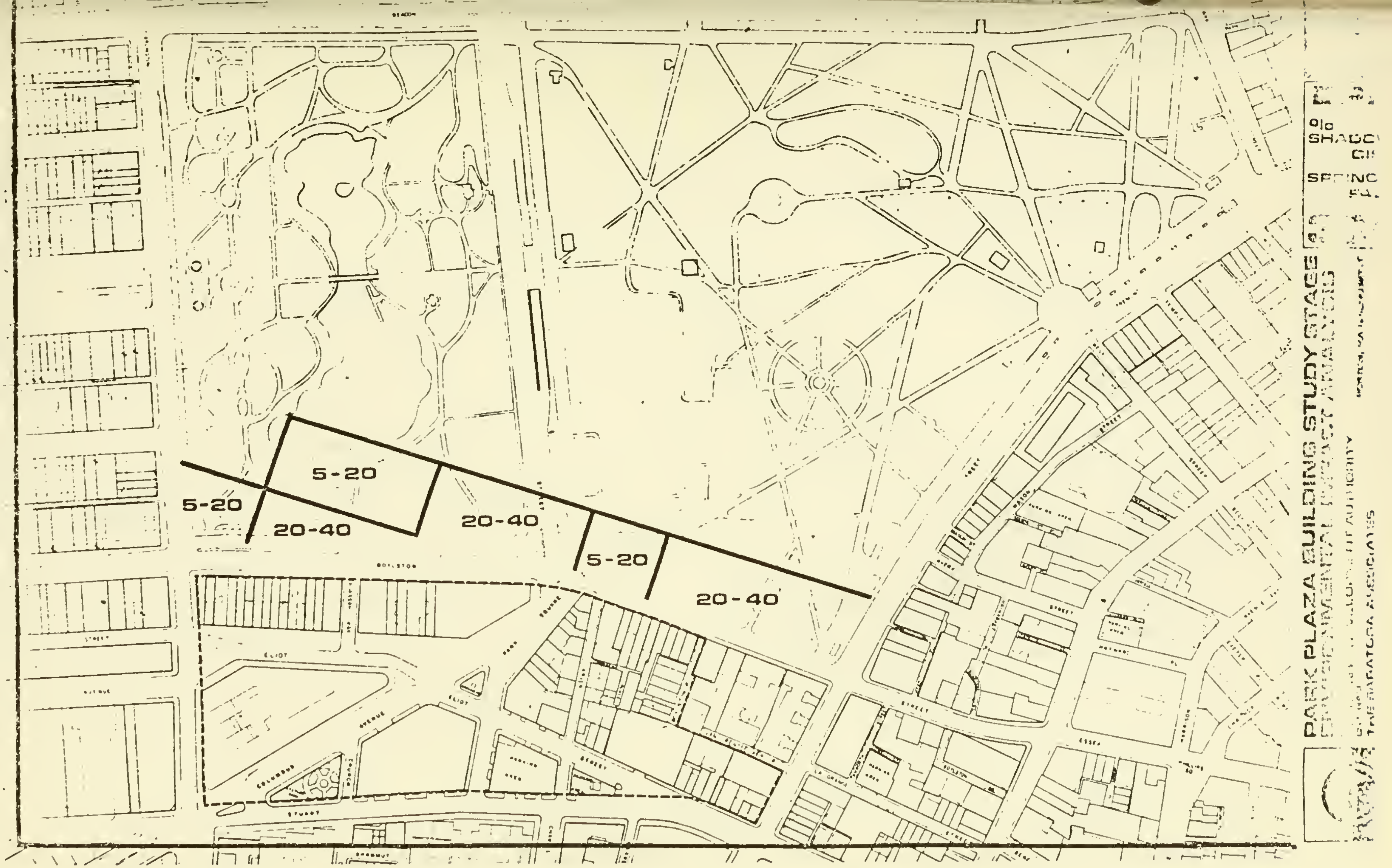
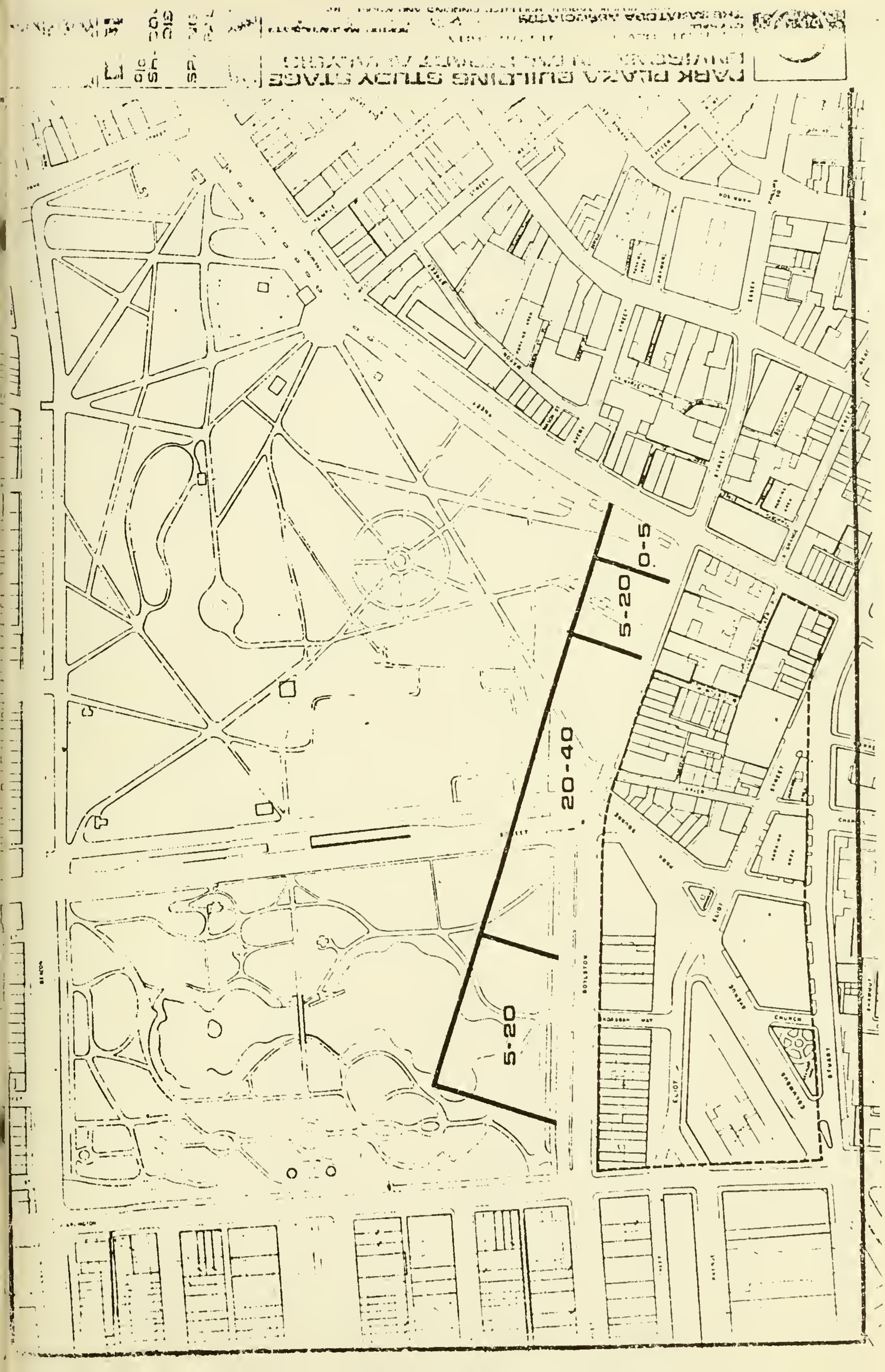
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
% SHADOW DIST
SPRING/ FALL
20-40
60-100
20-40
5-20



PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
THE SARATOGA ASSOCIATES
% SHADOW
SPRING
5-20
20-40
5-20
20-40
20-40
5-20
20-40
BOYLSTON
ELIOT
ELIOT
STREET
AVENUE
COLUMBUS
STUART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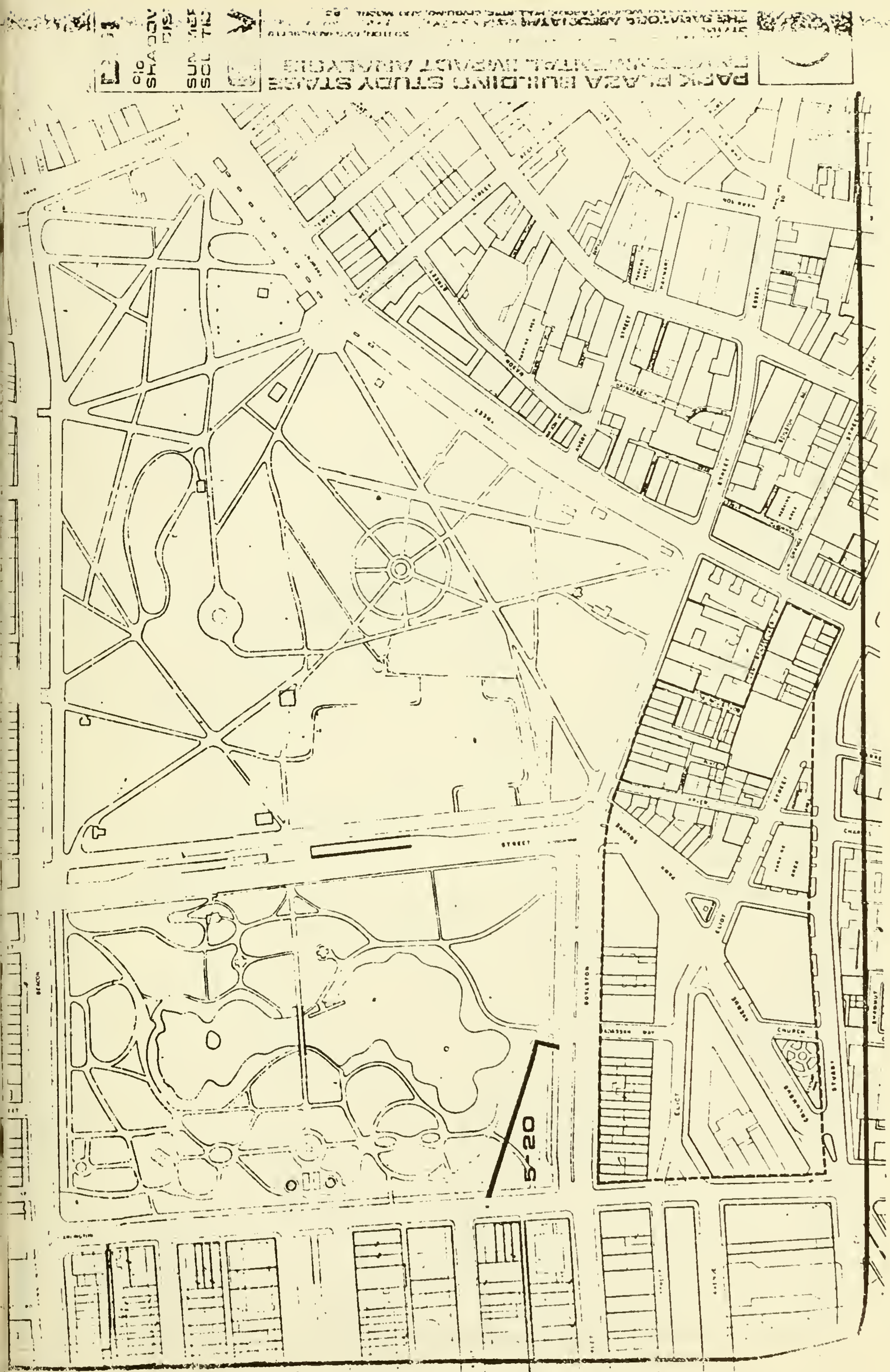
0-5
5-20
20-40
5-20
BOYLSTON
CHARLES
ELIOT
CHURCH
STUART
ARLINGTON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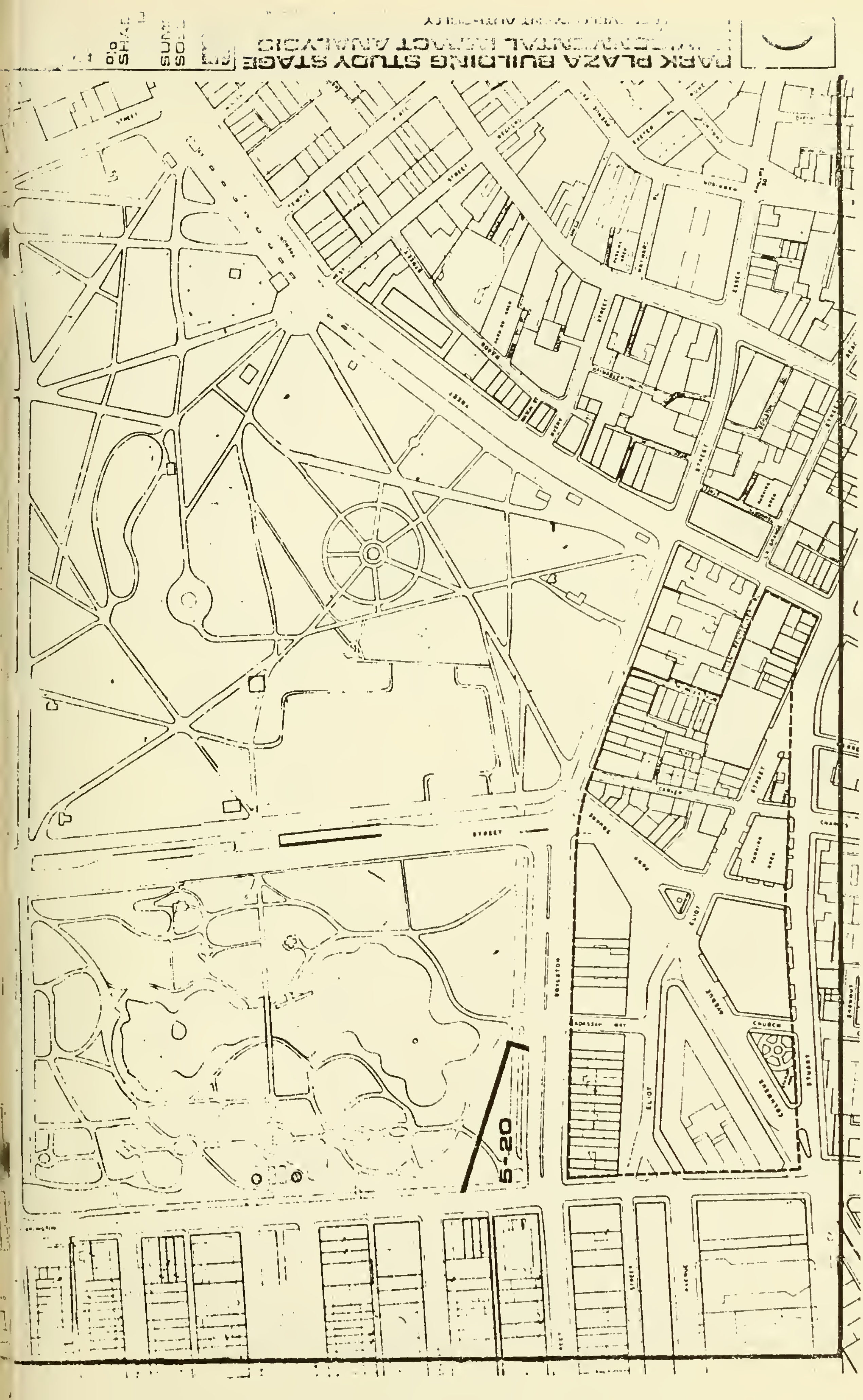
ENVIRONMENTAL IMPACT ANALYSIS
5-20
STREET
BOYLSTON
CHURCH
ELIOT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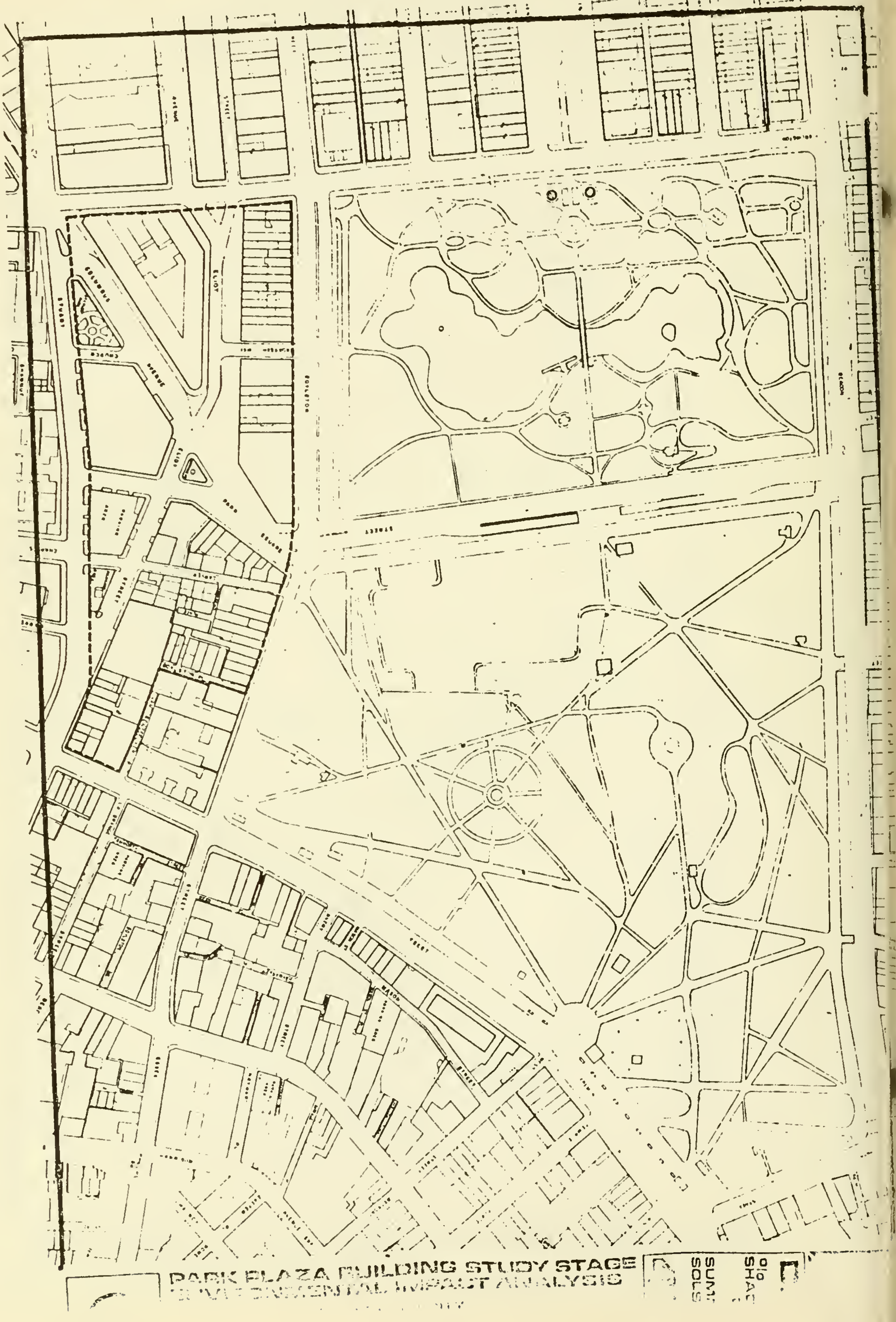
5-20
STREET
BOYLSTON
ELIOT
CHURCH
STUART
COLUMBUS
ESSEX
CHARLES
ARLINGTON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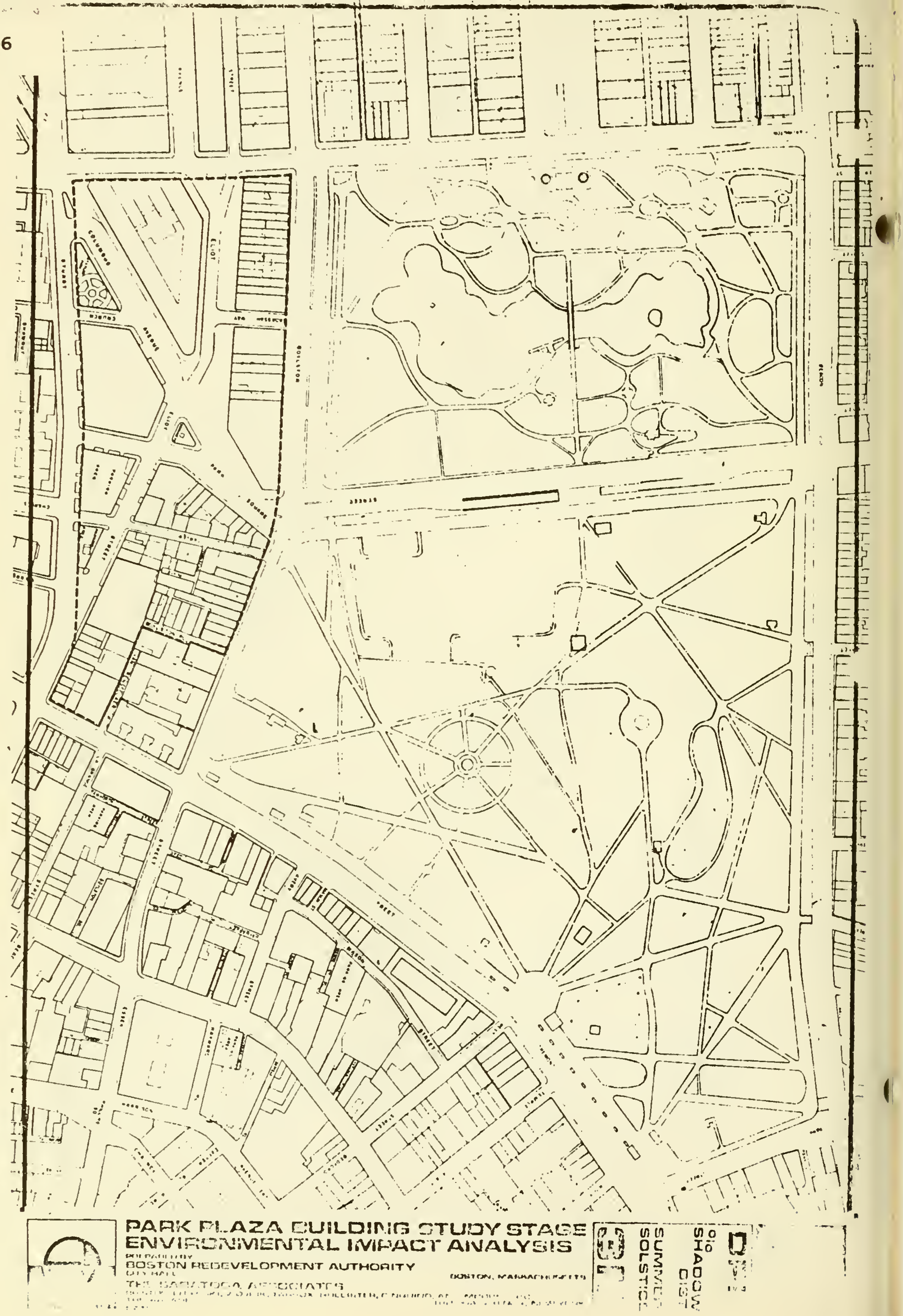
SOLS
SHA
BEACON
BOYLSTON
STREET
PARK
SQUARE
ELIOT
COLUMBUS
AVENUE
CHURCH
STREET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BOSTON, MASSACHUSETTS
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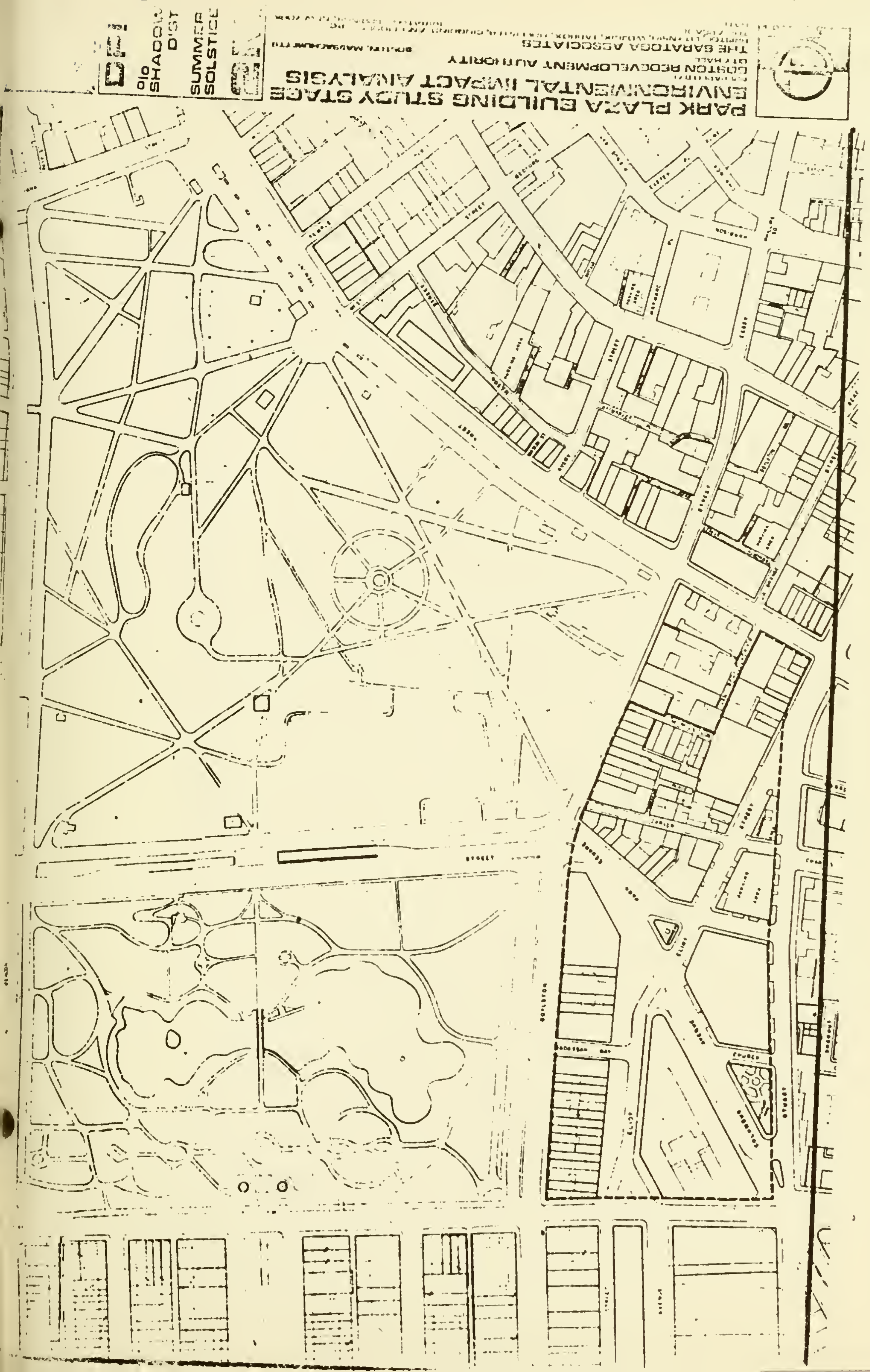
SUMMER SOLSTICE
% SHADOW DIST
BOYLSTON
STREET
ELIOT
COLUMBUS
CHURCH
STUART
PARK SQUARE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ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
THE SARATOGA ASSOCIATES
SUMMER SOLSTICE
SHADOW DIST
STREET
BOYLSTON

SURFICIAL HYDROLOGY

For a description of any significant environmental impacts, refer to Chapter 6 - Testing and Evaluation.

SUBSURFACE HYDROLOGY

Actions affecting Subsurface Hydrology are described in the section entitled Bedrock Geology.

VEGETATIVE RESOURCES

For a description of any significant environmental impacts, refer to Chapter 6 - Testing and Evaluation.

FAUNAL RESOURCES

For a description of any significant environmental impacts, refer to Chapter 6 - Testing and Evaluation.

PERCEPTUAL ENVIRONMENT

PERCEPTUAL ENVIRONMENT - NOISE[1]

Based on the traffic estimates prepared by Cambridge Systematics, Inc., the traffic volume will generally not be very much higher than the existing volume (see accompanying tables). A doubling of the volume of traffic would be necessary to produce an increase in the L_{10} (L_{10} is a noise descriptor used extensively in evaluating traffic noise; e.g., see PPM 90-2 of the FHWA. It represents the noise level exceeded 10% of the time, for the period specified) of the order of 3 dB. Since the human ear is not especially sensitive to a change of only 3 dB, it is more than likely true that there would not be a major traffic noise impact for any of the alternative development schemes.

There may be highly localized problems, that can be mitigated, but whose appearance should be anticipated. For example, the circular entrance/exit ramps for the parking garage could be (localized) sources of annoying noise. However, if the ramps are not completely open, and if the ramp surfaces are of a material with a high coefficient of friction (not smooth and slippery), then there will be no serious problems.

Further, the straightening out of Charles Street and the introduction of a traffic light between Charles Street and the new West-Bound Connector, could introduce localized annoyance at the new intersection. However, as that new signal appears to be under the garage and other development buildings, the noise at

---

[1] Bolt, Beranek and Newman, 1975

that intersection may be a problem only to occupants of the development immediately adjacent to the intersection, and not to the surrounding community.

Thus, measured according to an incremental criterion relative to the existing ambient noise levels, with due regard to potential local problems, there should be no impact due to traffic noise for any of the alternative schemes.

Building Mechanical Equipment

Mechanical systems components located in and on buildings can and do introduce noise that impacts on the surrounding environment. Further, unlike some traffic noise sources, these systems radiate noise in the same place, at a relatively continuous level.

Such potential noise sources could include intake and exhaust louvers, discharge stacks, area ways, cooling towers and other externally located noise generating equipment. In several of these, the actual noise generator is somewhat removed from the "noise location", such as a fan placed behind a louver.

Obviously such equipment can have a noise impact, and so the

impact and possible means of noise control must be investigated. For the Park Plaza project, there is a likelihood that cooling towers provided for central air conditioning could be such a noise source.

In Figures 2 and 3 are presented an analysis of potential noise levels due to air conditioning equipment. The following assumptions are incorporated into the analysis:

1. It is assumed, in each case, that the entire project is to be air-conditioned.

2. In the case of propeller type cooling towers, it is assumed that the project will be cooled from a central station type plant located within the project.

3. The centrifugal type cooling towers assume a "decentralized" concept of several groups of towers serving individual building elements or segments of the entire project.

4. Tons of refrigeration required for cooling was estimated by assigning an arbitrary allocation of 300 square feet of floor area per ton of refrigeration. Even extreme variations from the foregoing allocation would not result in any significant change in estimated noise levels. This can be seen by comparing the three

million against the six million square foot project, which represents a 3 dB difference.

5. Cooling towers located out-of-doors are assumed to be the single most significant noise contributor employed in the mechanical systems serving the project. Emergency electric generators are not included in this assumption because the scheduled use of this type of equipment is for emergency purposes only. This is not to say that other pieces of mechanical equipment (such as large fans) could not surface as noise problems.

6. In calculating the decay with distance of the sound pressure levels (Figure 3), molecular absorption, which is somewhat frequency dependent, as well as simple geometric spreading of the energy from a point-like (spherical) source has been accounted for.

In Figure 2 are displayed the radiated power levels for two different types of units. The propeller type is the type that would probably be used for a completely centralized system. A quieter alternative is a decentralized system of centrifugal cooling towers.

In Figure 3 the decay in sound pressure level with distance

from a central propeller unit is shown. Since the distance involved is straight line from the propeller tower to an observer, e.g., a man in the street, some benefit may be derived in placing a central system atop a tall building. Of course, this carries other penalties.

The final point is an important one; that is, it may be seen from Figure 2 that whether a large project is undertaken (six million square feet) or one of the smaller ones, the noise from a centralized system could be a significant problem that should be considered in the design development stage.

Projected Traffic Increases for Alternatives of Three Million Square Feet and Six Million Square Feet

Measurement Position (Number)	% dBA Peak Traffic Increase-3M	%dBA Peak Traffic Increase-6M
Arlington Street Church (1)	2	6
Intersec.-Stuart & Church Sts. (2)	43 (1)	104 (1)
Stuart St.-Oppos. Saxon Theater (3)	3 (2)	86 (2)
Intersec.-Boylston & Charles Sts. (4)	14 (3)	Not available
Intersec.-Winchester & So. Cedar Sts. (5)	0 (4)	0 (4)
By pond in Public Garden (6)	7 (5)	Not available

(1) Used traffic at Columbus-Arlington-Stuart Intersection.

(2) Used E-W traffic at Washington-Kneeland Intersection.

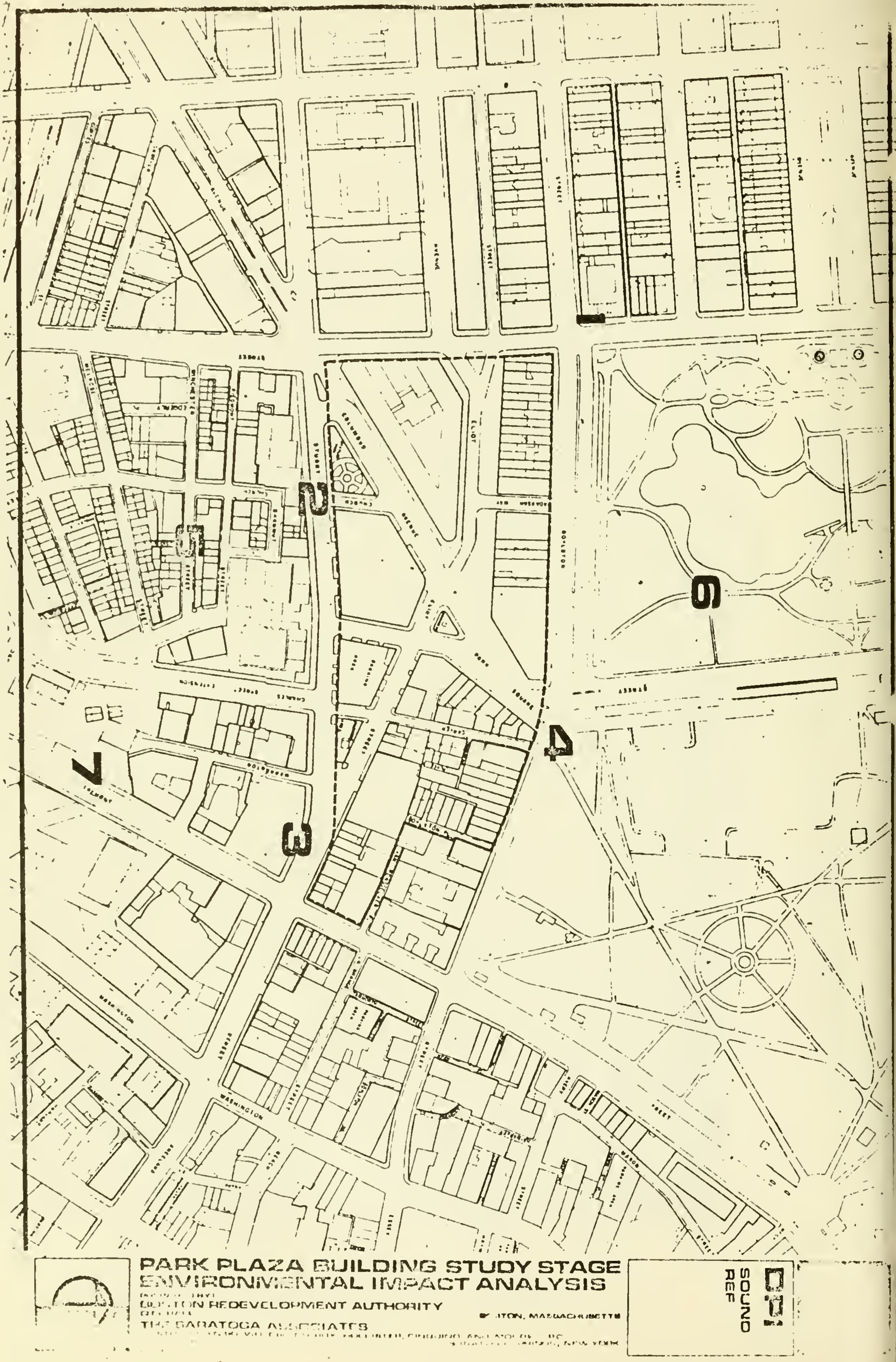
(3) Used double N-S traffic at Charles-Boylston Intersection.

(4) Distinctly residential "off-track" location: expect no effect of traffic volume from Park Plaza.

(5) Used N-S traffic at Charles-Boylston Intersection.

Projected Increases in Ambient Noise Levels for Alternatives of Three Million Square Feet and Six Million Square Feet

Measurement Position (Number)	Noise Increase for 3 Million Square Feet	Number for 6 Million Square Feet
	dBA	dBA
Arlington Street Church (1)	0	0
Intersec.-Stuart & Church Sts. (2)	2	3
Stuart St.-Oppos. Saxon Theater (3)	0	3
Intersec.-Boylston & Charles Sts. (4)	1	Not available
Intersec.-Winchester & So. Cedar Sts. (5)	0	0
By pond in Public Garden (6)	0	Not available

2
3
4
6
7
BOYLSTON
STREET
ELIOT
COLUMBUS
CHURCH
CHARLES STREET EXTENSION
WINCHESTER
EDGERLY PL
WASHINGTON
AVENUE
PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
BOSTON, MASSACHUSETTS
THE SARATOGA ASSOCIATES
SARATOGA SPRINGS, NEW YORK
SOUND REF

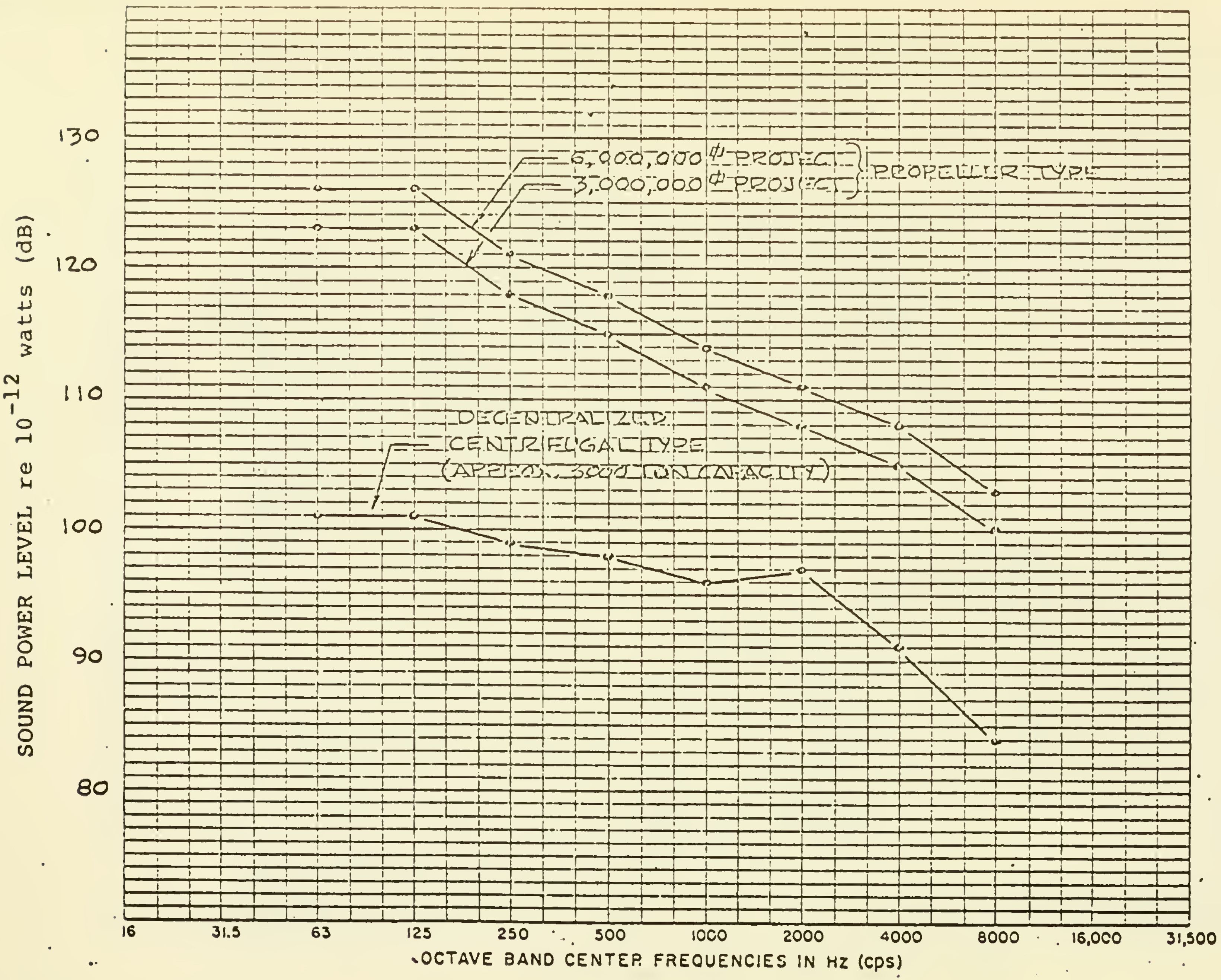


FIG. 2: SOUND POWER LEVELS FOR COOLING TOWERS

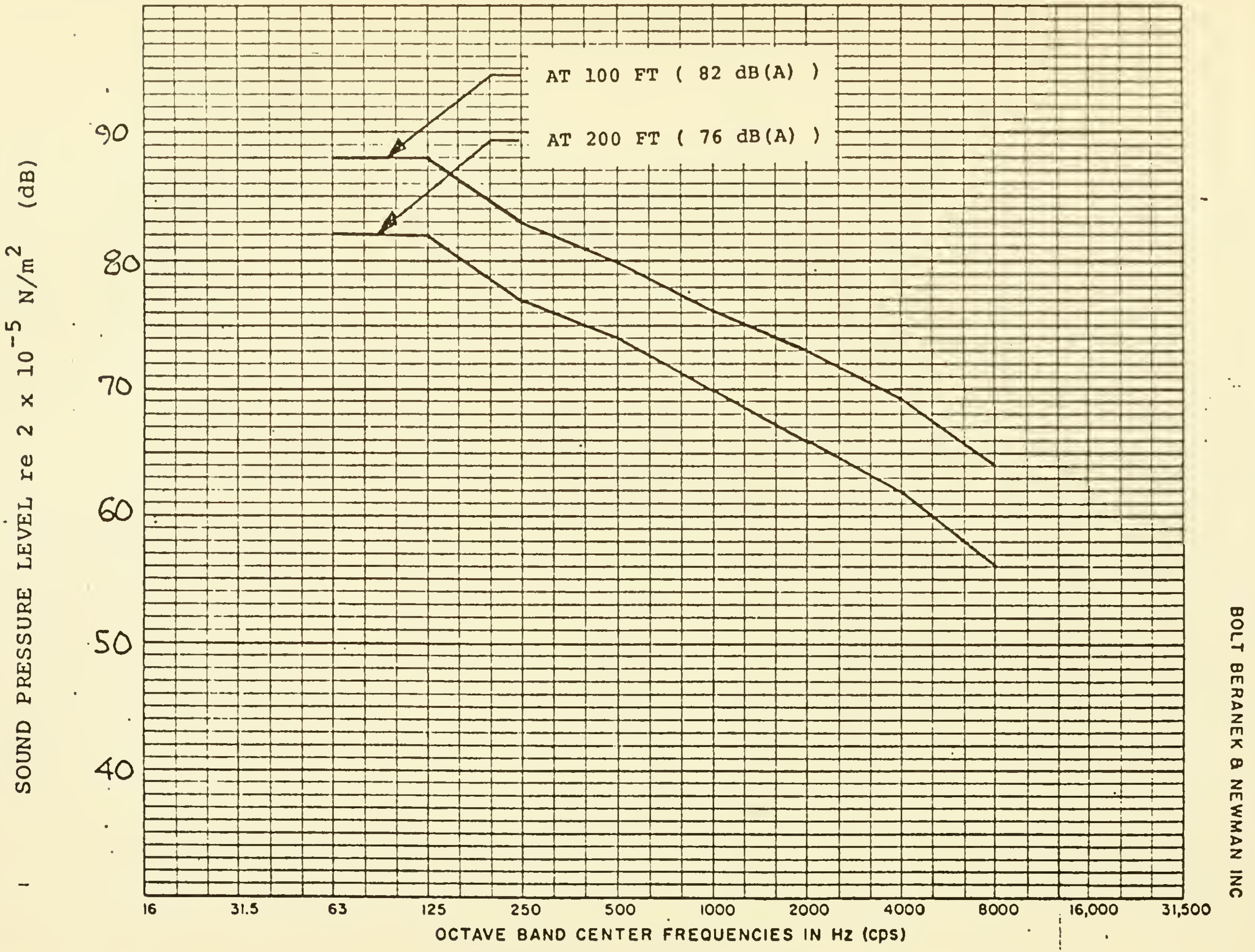
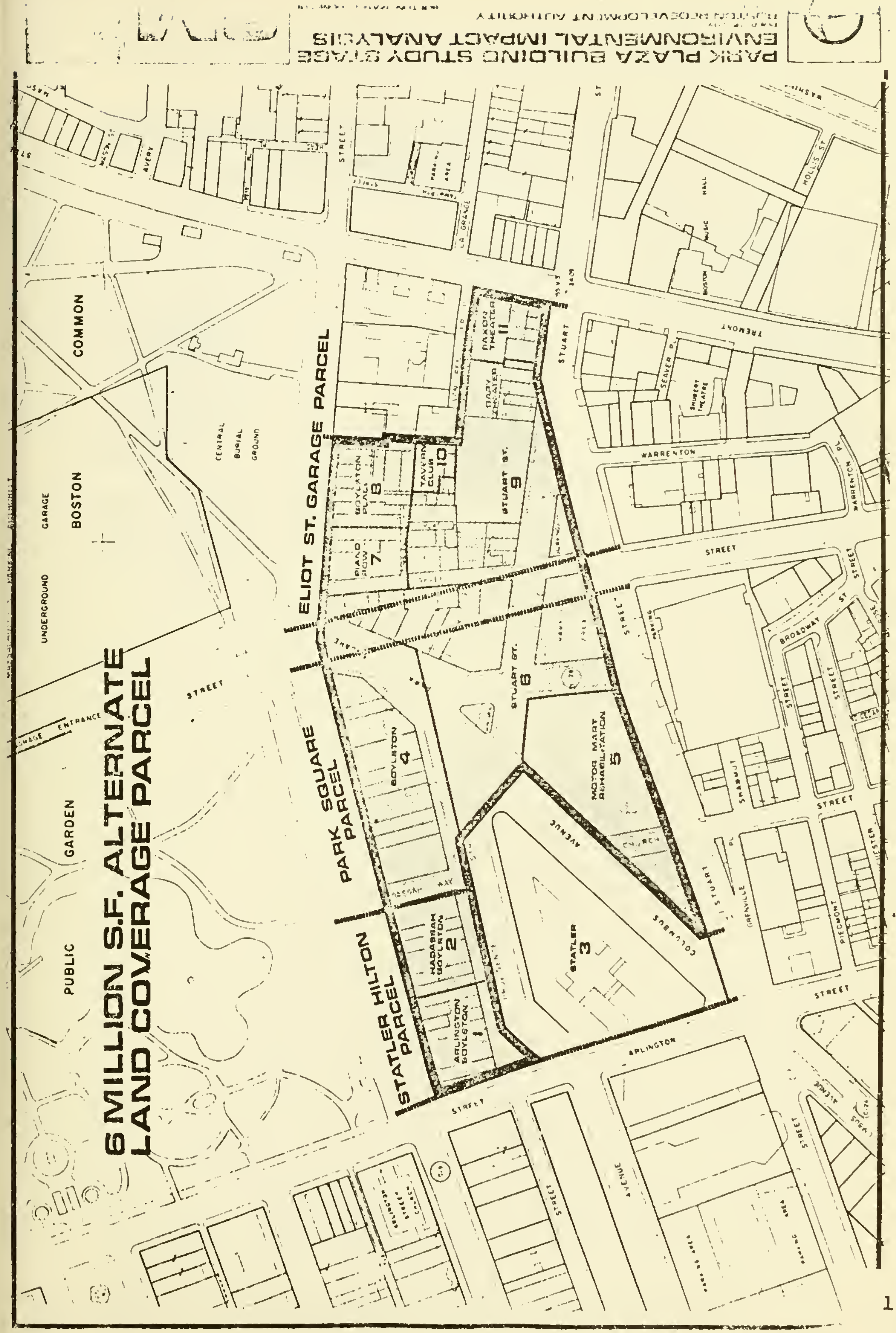


FIG. 3: DECAY WITH DISTANCE OF COOLING TOWER NOISE

LAND USE

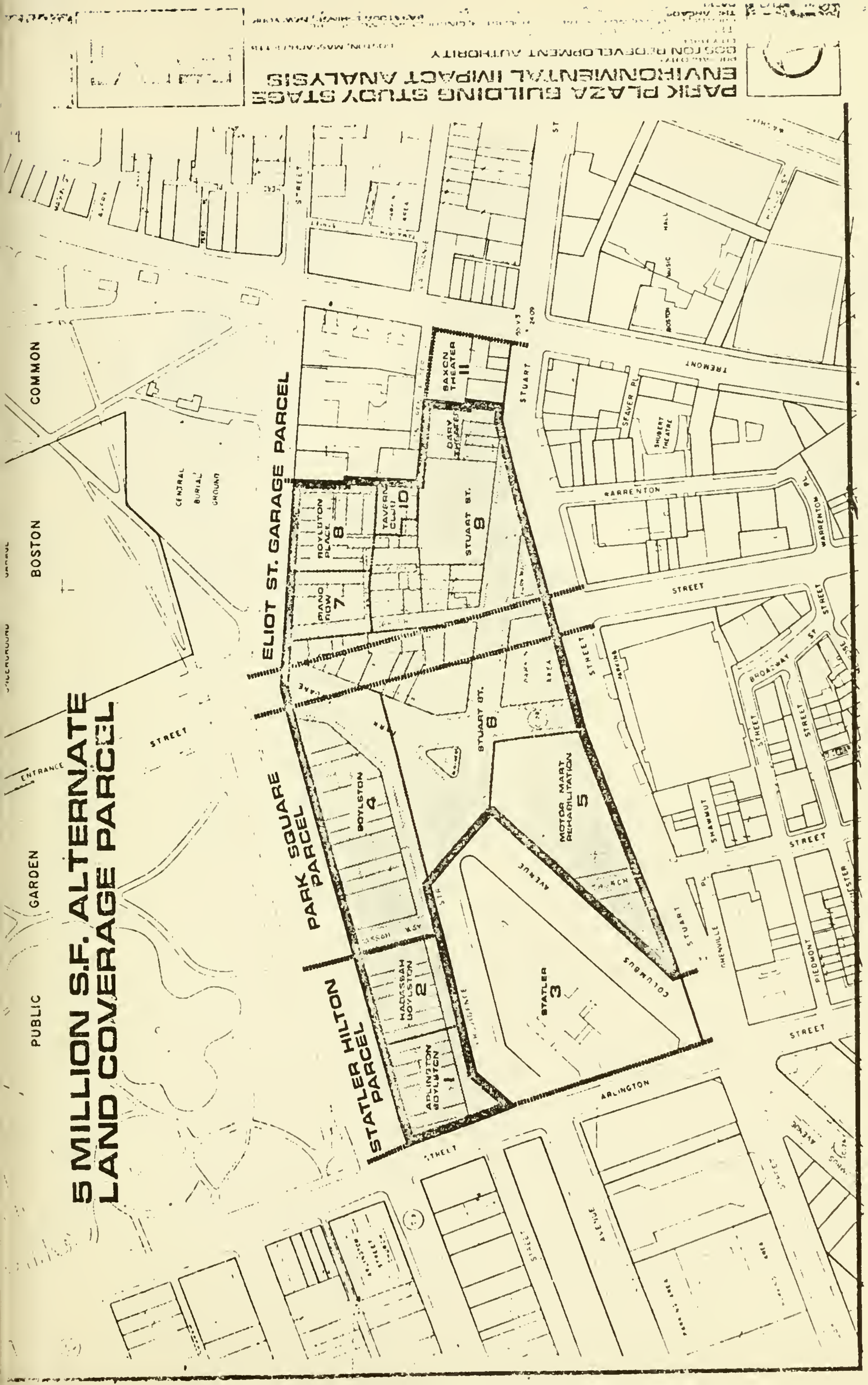

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
6 MILLION S.F. ALTERNATE
LAND COVERAGE PARCEL
STATLER HILTON PARCEL
PARK SQUARE PARCEL
ELIOT ST. GARAGE PARCEL
BOSTON COMMON
PUBLIC GARDEN
UNDERGROUND GARAGE
CENTRAL BURIAL GROUND
GARAGE ENTRANCE
ARLINGTON BOYLSTON 1
HADASSAH BOYLSTON 2
STATLER 3
BOYLSTON 4
MOTOR MART REHABILITATION 5
STUART ST. 6
PIANO ROW 7
BOYLSTON PLACE 8
STUART ST. 9
TAVERN CLUB 10
PAXON THEATER 11
BARY THEATER
SHUBERT THEATRE
BOSTON MUSIC HALL
COLUMBUS AVENUE
ARLINGTON STREET
STUART STREET
TREMONT
WARRENTON
WARRENTON PL
SEAVER PL
BROADWAY
SHAWMUT
GRENVILLE PL
PIEDMONT
CHESTER
CHURCH
HOLLIS ST
WASHINGTON
AVERY
LA GRANGE
STREET
PARKING AREA

SIX MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM
5.9M SQ. FT. NEW DEVELOPMENT

#	PARCEL	LAND AREA SQ. FT.	LAND ASSEMBLY COST*
1&2	Boylston	60,175	$5,123,000
4	Boylston	80,417	5,438,500
5	Motor Mart	68,240	3,241,000
6	Stuart	83,720	2,289,500
7	Piano Row	22,542	1,297,000
8	Boylston	27,216	1,894,000
9&10	Stuart	93,312	4,231,000
11	Saxon	20,277	1,497,000
TOTAL RETAINED			
TOTAL ACQUIRED		455,899	$25,011,000

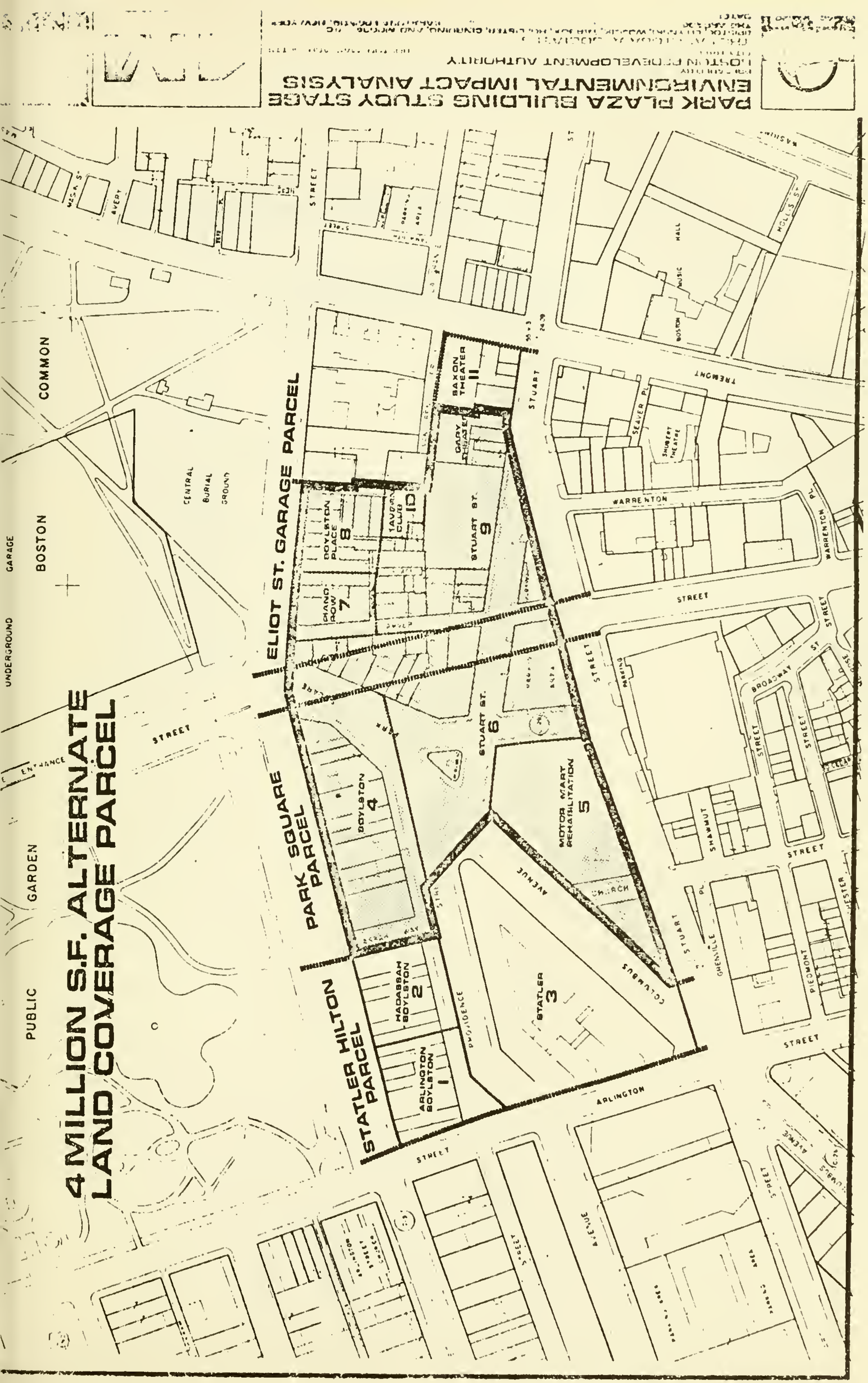
* includes acquisition, relocation, demolition.


5 MILLION S.F. ALTERNATE
LAND COVERAGE PARCEL
PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
ELIOT ST. GARAGE PARCEL
PARK SQUARE PARCEL
STATLER HILTON PARCEL
ARLINGTON BOYLSTON 1
HADASSAH BOYLSTON 2
STATLER 3
BOYLSTON 4
MOTOR MART REHABILITATION 5
STUART ST. 6
PIANO ROW 7
BOYLSTON PLACE 8
STUART ST. 9
TAVERN CLUB 10
SAXON THEATER 11
DARY THEATER
BOSTON COMMON
PUBLIC GARDEN
CENTRAL BURIAL GROUND
ENTRANCE
STREET
STUART
TREMONT
WARRENTON
WARRENTON PL.
SEAVER PL.
SHUBERT THEATRE
BOSTON MUSIC HALL
BROADWAY
SHAWMUT
STUART ST.
GRENVILLE
PIEDMONT
CHESTER
COLUMBUS
AVENUE
ARLINGTON
PROVIDENCE
STREET

FIVE MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM
4.9M SQ. FT. NEW DEVELOPMENT/.04M SQ. FT. RETENTION

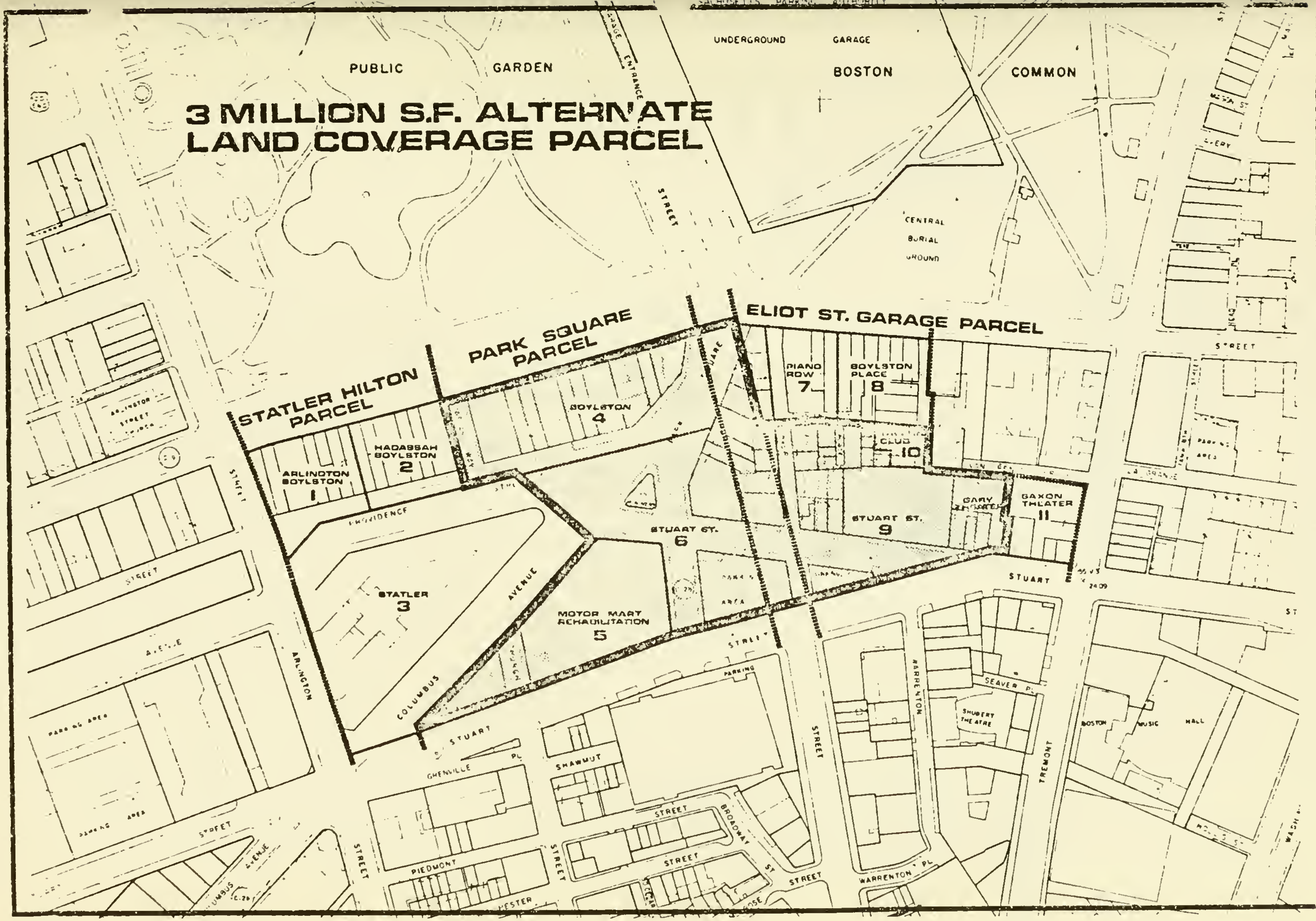
#	PARCEL	LAND AREA SQ. FT.	LAND ASSEMBLY COST
1&2	Boylston	60,175	$5,123,000
4	Boylston	80,417	5,438,500
5	Motor Mart	68,240	3,241,000
6	Stuart	83,720	2,289,500
7	Piano Row	22,542	1,297m000
8	Boylston	27,216	1,894,000
9&10	Stuart	93,312	4,231,000
TOTA: RETAINED		20,277	1,497,000
TOTAL ACQUIRED		435,622	23,514,000
TOTAL		455,899	25,011,000


PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
4 MILLION S.F. ALTERNATE
LAND COVERAGE PARCEL
ELIOT ST. GARAGE PARCEL
PARK SQUARE PARCEL
STATLER HILTON PARCEL
ARLINGTON BOYLSTON 1
HADASSAH BOYLSTON 2
STATLER 3
BOYLSTON 4
MOTOR MART REHABILITATION 5
STUART ST. 6
PIANO ROW 7
BOYLSTON PLACE 8
STUART ST. 9
TAVERN CLUB 10
SAXON THEATER 11
GARY THEATER
CHURCH
BOSTON COMMON
UNDERGROUND GARAGE
CENTRAL BURIAL GROUND
PUBLIC GARDEN
ENTRANCE
STREET
PARK
PROVIDENCE
COLUMBUS AVENUE
ARLINGTON
STUART
TREMONT
WARRENTON
WARRENTON PL
SEAVER PL
SHUBERT THEATRE
BOSTON MUSIC HALL
HOLLIS ST
AVERY
MASON ST
STREET
BROADWAY
SHAWMUT
GRENVILLE
PIEDMONT
CHESTER
PARKING
AVENUE

FOUR MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM
3.8M SQ. FT. NEW DEVELOPMENT
.26 M SQ. FT. RETENTION

#	PARCEL	LAND AREA SQ. FT.	LAND ASSEMBLY COST
4	Boylston	80,417	5,438,500
5	Motor Mart	68,240	3,241,000
6	Stuart	83,720	2,289,500
7	Piano Row	22,542	1,297,000
8	Boylston	27,216	1,894,000
9&10	Stuart	93,312	4,231,000
TOTAL RETAINED		80,452	6,620,000
TTAL ACQUIRED		375,477	18,391,000
TOTAL		455,899	25,011,000



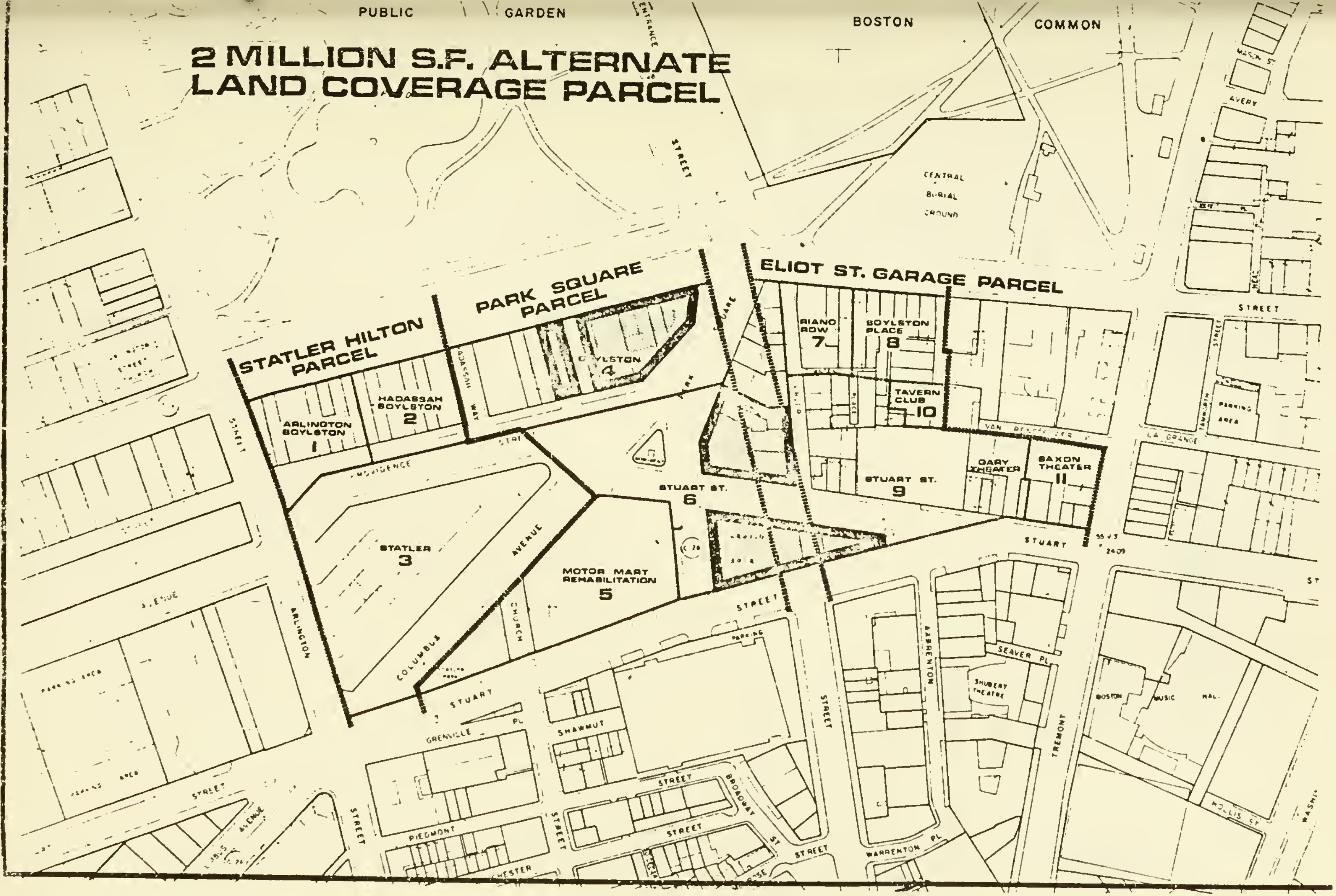
3 MILLION S.F. ALTERNATE LAND COVERAGE PARCEL

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY

THREE MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM
3.3M SQ. FT. NEW DEVELOPMENT
.42M SQ. FT. RETENTION

#	PARCEL	LAND AREA SQ. FT.	LAND ASSEMBLY COST
4	Boylston	80,417	5,438,500
5	Motor Mart	68,240	3,241,000
6	Stuart	83,720	2,289,500
9&10	Stuart	93,312	4,231,000
TOTAL RETAINED		130,210	9,811,000
TOTAL ACQUIRED		325,689	15,200,000
TOTAL		455,899	25,011,000



2 MILLION S.F. ALTERNATE LAND COVERAGE PARCEL

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY

TWO MILLION SQUARE FOOT ALTERNATIVE

DEVELOPMENT PROGRAM
"NO BUILD" OPTION (.8M SQ. FT. NEW DEVELOPMENT 1.2M SQ. FT. RETENTION)

	Land Areas	Total Land Cost
Parcel S2B3A/5	5,600	457,000
Parcel S2B3A/1, 2, 3	31,950	2,352,000
Parcel 394/5	22,025	1,354,000
Parcel 397/4	26,000	1,172,000
TOTAL RETAINED	370,324	19,676,000
TOTAL ACQUIRED	85,575	5,335,000
TOTAL	455,899	25,011,000

BUILT CHARACTER

BUILT CHARACTER ARCHEOLOGIC FEATURES

A problem which might arise would be the encountering of Pre-Columbian Indian artifacts which might warrant archaeological investigation. Ancient fish weirs have been encountered previously during the construction of the Boylston Street subway and the New England Life Building. According to Douglas Byers, an archaeologist who participated in the investigation of the weir found at New England Life, the possibility of similar finds in the Park Plaza area would be very good. The problem would arise from the fact that investigation of such discoveries could interfere with construction. Therefore, allowance for this possibility and the means of handling it should perhaps be anticipated in construction documents. In essence this anticipation should be some kind of formula for compensation to the contractor and perhaps the developer if it were deemed in the public interest to interfere with construction for the purpose of archaeological investigation. The possibility of encountering colonial and post-colonial artifacts east of Carver Street should also be given consideration.

CIRCULATION

TRANSPORTATION IMPACTS [1]

The introduction of a major and large new activity center, such as is represented by the Park Plaza Urban Renewal Project, into the core area of Boston has the potential to impact the operation of the City's transportation system - the network of expressways, local streets, intersections, sidewalks, parking facilities, bus routes, light rail and rapid lines, and commuter rail facilities which employees, shoppers, and visitors utilize in making trips within the downtown area. DPI elements of the transportation analysis undertaken by Cambridge Systematics, Inc. reported on herein include the following tasks:

- Forecast the trip making behavior of Park Plaza occupants and visitors;
- Estimate the modes of travel of people to Park Plaza for different trip purposes, and the impacts which these projected new trips would have on the area's transportation facilities.

The study has been intended to both update previous Park Plaza transportation related studies and to examine potential impacts in more depth than in previous studies. Given the history of previous Park Plaza submissions, the inherent complexity of this

area of downtown Boston, and the close professional and public scrutiny to which Park Plaza information is being subjected, the study has carefully adhered to existing knowledge of travel behavior, utilized disaggregate data rather than areawide averages, and utilized an anlysis methodology which approximates as closely as was possible within the time and resources available the equilibrium condition of traffic operations. Major assumptions and areas of uncertainty in the analysis are discussed.

PARK PLAZA GENERATED TRIPS

The Park Plaza development will generate or attract trips associated with its commercial offices, hotel, retail outlets, and residential living units. To forecast the transportation impacts of each of the Park Plaza alternatives, it is first necessary to estimate the following five kinds of information:

- Population characteristics of occupants and visitors for each alternative.
- Daily trips generated by each activity type.
- Distribution of these trips by time of day.
- Geographic distribution of the origins and destinations of these trips.
- Modal facilities most likely to be utilized for each type of trip.

This chapter summarizes the data which have been collected and analyzed in each of these areas. These numbers are then used as the basis for the traffic assignments and parking analyses.

Population Characteristics

The estimated daily user populations for each of the five basic Park Plaza alternatives are tabulated in Table IV-1. The population is categorized by office employees, business visitors, retail employees, shoppers, hotel employees, hotel visitors, and residents. The peak period for both shopping and hotel visits is the fall when 35% of the total estimated annual shopping visits and 36% of the total estimated annual hotel visits occur. It is the associated daily figures that are contained in Table IV-1 since the transportation analysis is oriented toward the peak or worst period.

For each activity type, the population is further divided into trips that originate from on-site, from within downtown Boston, and from outside the downtown area. Different transport modal split assumptions are used for each of these areas. Those office employees that also reside in Park Plaza apartments are assumed to walk to work and are excluded from the population totals.[2] The numbers in the right-hand column then reflect total person trips coming to Park Plaza from somewhere within

the Boston area. In the case of shopping trips, these numbers do not constitute individual store visitations. A single person coming from either downtown or outside downtown will likely visit multiple stores. Also, shopping visits exclude all shopping trips that originate from within Park Plaza itself; for example, a noon shopping trip by an office employee. All such trips are assumed to involve only walking. Other assumptions utilized in deriving these numbers are described in the cited BRA source document.

For the purposes of this analysis, each member of a population type generally is assumed to make one trip arriving at and departing from Park Plaza. For example, an office employee arrives in the morning and departs in the afternoon. Since the worst traffic conditions will be the A.M. and P.M. peaks, it is reasonable to ignore any trips that may be made by auto or transit during the day. Similarly, each shopping visit is assumed to involve a single trip.[3] In contrast, most hotel visitors generate multiple trips in a single day.

Distribution of Trips by Time of Day

Trips by activity type are distributed over time with peaks occurring at different times for different types of trips.

From Table IV-1, it is seen that office employees and shoppers constitute the two largest population groups. It is these two groups for which assumptions concerning times of arrival and departure are most critical. The assumed percentage of trips in the A.M. peak (8-9) and P.M. peak (5-6) are tabulated in Table IV-2. These assumptions are based on the results of previous BRA surveys and reports, other portions of the Park Plaza Environmental Analysis, and Massachusetts Department of Public Works sponsored studies, and material published by the Transportation Research Board.[4]

The arrival times of parkers to the Boston Common Garden provides an indication of the arrival times of workers to this area of downtown Boston.[5] It is assumed, conservatively, that 67% of the employees will arrive and depart during the respective peak hours. Business related visitors are assumed to arrive/ depart throughout the day, with 10% falling in each peak hour. Because retail facilities open either after 9:00 a.m. or prior to the morning commute, the percent of retail employees arriving on site during the A.M. peak is assumed to be 20% of all retail employees. For the P.M. peak hour (5:00-6:00 p.m.), 40% of the retail employees are assumed to leave the site. This number is higher than the A.M. peak because many retail facilities may close during the 5:00-6:00 p.m. period. The remainder of the retail employees are assumed to be involved either with establishments having a later closing hour or in activities that would

necessitate them leaving work either before 5:00 or after 6:00 p.m. For both peaks, it is assumed that hotel employees arrive and depart during off-peak periods thus contributing no peak hour trips. Hotel employees shift changes occur at times other than the A.M. and P.M. peaks in order to achieve a higher efficiency in serving hotel guests.

Shopping trip arrivals are estimated to be distributed over time as is shown in Table IV-3. For purposes of the transportation analysis, it is assumed that 7% of the arrivals to the site area will occur during the A.M. peak. For the P.M. peak, 20% of all shoppers are assumed to leave from Park Plaza.

The trip making patterns of Park Plaza residents generally will be the reverse of those working and shopping on the site. As indicated in Table IV-1, most Park Plaza residents who work are assumed to have the site for work elsewhere in Boston. Consequently, it is assumed that residents make no inbound A.M. peak trips. However, 10% of the residents are assumed to make a P.M. outbound trip; e.g., for dinner, shopping, etc. These P.M. outbound trips are assumed to be made half outside and half inside downtown. Analysis of the reverse commuting patterns indicated that these trips would not add significantly to the transportation impacts of Park Plaza. In designing street

access and traffic flow patterns to serve the peaking conditions, care must be taken not to impede or block these reverse flow trips.

For hotel guests, approximately 10% of the population are assumed to make a trip to the site in the A.M. peak, and 25% to make an outbound trip in the evening peak. The latter figure is higher than the former because some hotel guests beginning trips for dinner, entertainment, etc., will coincide with the evening peak. They are assumed to make half of their trips inside downtown and half outside.

Corridor and Modal Allocation of Trips

The final two sets of numbers utilized in the transportation analysis are:

- The distribution of trips by corridor, and
- The distribution of trips within a corridor to modal facilities.

Modal choice is known to be a function of several variables including trip purpose, relative travel times among the available options, income level, modal accessibility, and travel cost. Several major previous transportation studies have conducted

either household or person surveys to determine travel behavior. The approach utilized in this study was to examine these earlier efforts and to select what appeared to be the most reasonable figures. These previous studies are the 1963 home interview survey of the Eastern Massachusetts Regional Planning Project (E.M.R.P.P.), the 1970 U.S. Department of Commerce Population Census, the 1972 study of Boston Parking needs by Wilbur Smith and Associates where nine major office-commercial developments were surveyed, and selected studies of individual new developments by Barton-Aschman Associates. The differences in these survey results indicate the range of uncertainty in existing modal choice.

Major access corridors are displayed in Figure II-2. Table IV-4 illustrates the allocation by corridor for trips entering the central core as determined in the 1963 E.M.R.P.P. and the 1972 Wilbur Smith surveys. The two studies obtained similar results, with both indicating a significant variation from a uniform distribution of 17%. Because the Wilbur Smith data included a further disaggregation by trip purpose and were also more current, it was decided to use these figures as a basis for distributing "outside downtown" Park Plaza trips.

Surveys of modal utilization have been conducted both for the region as a whole and for individual buildings. The results of

selected individual building surveys are displayed in Table IV-5. As can be seen, variations in modal split result with geographic location and activity type. The figures also demonstrate the differences in modal use between employee and non-employee trips. Jordan Marsh is located in the heart of downtown, is directly served by two subway lines, employs largely women, and has an employment generally from the lower to middle income ranges.[6] All of these factors contribute to the high transit utilization. None of the surveyed developments correspond in a closely analogous way to Park Plaza. However, it can be expected that the modal allocations for Park Plaza would fall somewhere between those for Jordan Marsh and the Prudential Center.

It is further known that there is a variation in modal allocation by corridor. Results of the E.M.R.P.P. and Wilbur Smith surveys for trips entering the central core are tabulated in Table IV-6. While there is a variation in the two survey results, it was decided to use the 1972 survey results because they were both more current and more reflective of the anticipated activity mix at Park Plaza.

Table IV-7 shows the results of this survey tabulated both by corridor and by employee or non-employee (e.g., shopping trip).

For trips of each type allocated to a corridor, these figures are used to determine the utilization of the various modes available within the corridor.[7]

Separate modal split assumptions are made for Park Plaza trips to and from downtown. These are assumed to be 60% transit and 40% walk. Because the residential areas in the Back Bay and Prudential Center lie to the west, transit trips in downtown are assumed to further split 80% and 20% for the Green Line Copley Square and Park Street approaches respectively. Hotel guests are assumed to distribute among the corridors as follows: 70% airport (northeast), and 30% evenly among the remaining five corridors.

[1] Cambridge Systematics, Inc., 1975.

[2] No retail or hotel employees are assumed to live within the site area.

[3] Several shoppers, however, may come in a single automobile. Assumptions of car occupancy are described later.

[4] One source summarizing previous studies of office buildings is "Urban Travel Patterns for Hospitals, Universities, Office Buildings, and Capitols", National Cooperative Highway Research Program Report 62, National Academy of Sciences, Washington, D.C., 1969.

[5] "An Access Oriented Parking Strategy for the Boston Metropolitan Area", prepared for the Massachusetts Department of Public Works by Wilbur Smith and Associates, July 1974: Figure 47, pg. 167.

[6] The 1970 U.S. Population Census of home-to-work trips for the Boston Metropolitan area, for work trips to the central city by persons living outside the central city, showed that 69% of the women utilized public transportation whereas only 45% of the men utilized one of the available public transport modes.

[7] The survey results showed 22 and 16% respectively of non-employee pedestrian trips from the southwest and southeast corridors. Because downtown originating trips are treated as a separate corridor, these two walk percentages were uniformly reallocated to other modes.

TABLE IV-1

Summary Table of Daily User Population

6 Million Alternative				
User	Origin			
	On Site	Downtown	Outside Downtown	Total
Office Employees	(168)	527	6840	7367*
Business Visitors	-	151	603	754
Retail Employees	-	30	1447	1477
Hotel Employees	-	14	680	694
Residents	2468	-	-	2468
Hotel (Fall, High Est.)	1573	-	-	1573
Shoppers (Fall)	-	4487	7404	11891
Total	4041*	5209	16974	26224
5 Million Alternative				
Office Employees	(158)	554	7204	7758*
Business Visitors	-	158	634	792
Retail Employees	-	27	1323	1350
Hotel Employees	-	14	680	694
Residents	1628	-	-	1628
Hotel (Fall, High Est.)	1573	-	-	1573
Shoppers (Fall)	-	4487	6955	11442
Total	3201*	5240	16796	25237
4 Million Alternative				
Office Employees	(90)	316	4107	4423*
Business Visitors	-	90	361	451
Retail Employees	-	21	1037	1058
Hotel Employees	-	14	680	694
Residents	1493	-	-	1493
Hotel (Fall, High Est.)	1573	-	-	1573
Shoppers (Fall)	-	3440	4801	8241
Total	3066*	3881	10986	17933

Summary Table of Daily User Population

3 Million Alternative				
	Origin			
User	On Site	Downtown	Outside Downtown	Total
Office Employees	(46)	159	2070	2229*
Business Visitors	-	46	182	228
Retail Employees	-	17	819	836
Hotel Employees	-	8	374	382
Residents	1125	-	-	1125
Hotel (Fall, High Est.)	787	-	-	787
Shoppers (Fall)	-	2917	4128	7045
Total	1912*	3147	7573	12632
2 Million Alternative				
Office Employees	(29)	101	1323	1424*
Business Visitors	-	29	116	145
Retail Employees	-	4	194	198
Hotel Employees	0	0	0	0
Residents	494	-	-	494
Hotel (Fall, High Est.)	0	0	0	0
Shoppers (Fall)	-	2000	0	2000
Total	494*	2134	1633	4261

* Excludes office employees who live in Park Plaza.

Source: B.R.A. Internal Memorandum, "Park Plaza Daily User Population", May, 1975.

TABLE IV-2

Assumed Distribution of Daily Trips by A.M. and P.M. Peak

Activity	A.M., %	P.M., %
Office Employee	67	67
Business Visitors	10	10
Retail Employees	20	40
Hotel Employees	0	0
Residents	0	10
Hotel Visitors	10	25
Shoppers	7	20

TABLE IV-3

Time Distribution of Shopping Trips

Season	%	Day	%
Winter	16%	9-12	20%
Spring	24%	12-2	30%
Summer	25%	2-6	40%
Fall	35%	6-9	10%

Source: Economic Resource Associates, Park Plaza Projected Characteristics of Residents, Office Workers, Retail Shoppers, and Hotel Employees, March 1975.

Boston Redevelopment Authority, Transportation Planning Department, 1975.

TABLE IV-4

Percentage Distribution of Person-Trips by Corridor by Employee - Non-Employee

Source	Corridor / Activity Type	NE	N	NW	W	SW	SE	Total (3)
W.S.A. (1)	Employee	13.8	14.5	9.2	17.0	21.7	23.7	100.0
	Non-Employee	13.6	9.6	9.8	16.4	22.6	28.1	100.0
	Total	13.6	12.0	9.5	16.8	22.2	25.9	100.0
E.M.R.P.P. (2)		11	17	11	17	18	26	100.0

(1) Wilbur Smith and Assoc., An Access Oriented Parking Strategy for the Boston Metropolitan Area, Final Report, July, 1974.

(2) 1968-69 Transportation Facts - Boston Region, B.R.A., 1968.

(3) "Other" trips greater than 50 but less than 500 miles are evenly distributed among suburban corridors.

TABLE IV-5

Disaggregate Modal Split Survey Results for Selected Developments

Mode	Jordan Marsh[1] Employee	Jordan Marsh[1] Shopping	Prudential[1] Employee	Prudential[1] Shopping	Nine Buildings Employee	Nine Buildings Non-Employee
Subway Bus	71.2	65.3	26.1	22.3	39%	35%
Automobile	15.4	26.8	54.2	44.6	35%	35%
Walk	11.5	5.4	14	29.3	5%	10%
Taxi	0	.5	0	1.7	0%	4%
Commuter Rail	1.9	1.7	5	1.9	9%	3%

Mode	Jordan Marsh[2] Employee	Jordan Marsh[2] Shopping	Prudential[2] Employee	Prudential[2] Shopping
Subway	82	48	29	19
Bus	8	9	9	3
Automobile	5	22	57	47
Walk	5	19	5	28
Taxi	0	2	1	5
Commuter Rail	-	-	-	-

1. Wilbur Smith and Associates, "An Access Oriented Parking Strategy for the Boston Metropolitan Area", 1974.

2. Barton-Aschman and Associates studies for LaFayette Place.

TABLE IV-6

Comparative Corridor Modal Split Data

Corridor	Mode	% E.M.R.P.P.(1)	% 1972 W.S.A.(2)
Northeast	Auto	46	44
	Transit	54	56
North	Auto	45	41
	Transit	55	59
Northwest	Auto	49	32
	Transit	51	68
West	Auto	50	45
	Transit	50	55
Southwest	Auto	39	49
	Transit	61	51
Southeast	Auto	54	45
	Transit	46	55

(1) B.R.A., 1968-69 Transportation Facts - Boston Region, Second Edition, 1968.

(2) Wilbur Smith and Associates, "An Access Oriented Parking Strategy for the Boston Metropolitan Area", 1974.

TABLE IV-7

Modal Utilization by Corridor and by Employee/Non-Employee (In Percent)

Corridor Mode[2]	Northeast		North		Northwest		West		Southwest[2]		Southeast[2]		Total	
	E	N-E	E	N-E	E	N-E	E	N-E	E	N-E	E	N-E	E	N-E
Auto[1]	36.8	53.1	38.5	44.5	25.2	40.5	42.5	47.9	31.7	40.7	41.0	33.2	36.6	42.4
Subway	46.8	32.7	37.5	30.8	60.8	46.5	33.8	32.9	44.1	38.0	35.9	48.2	40.9	37.6
Bus	9.3	12.2	6.3	10.6	5.8	8.6	17.6	16.8	7.4	14.5	18.0	18.4	12.2	14.5
Commuter Rail	6.9	1.0	17.7	14.1	8.2	4.2	6.1	2.4	16.8	6.5	5.0	0.0	10.3	5.2

Source: Wilbur Smith and Associates, "An Access Oriented Parking Strategy for the Boston Metropolitan Area", 1974.

1. Includes "taxi", "auto passenger", and "carpool".

2. "Walk" and "other" modes evenly distributed between the four major modes.

SIX MILLION ALTERNATIVE

includes

1. Street Volumes (AM-PM)
2. Intersection Volumes (AM-PM)
3. Transit Volumes (AM-PM)
4. Parking Loads

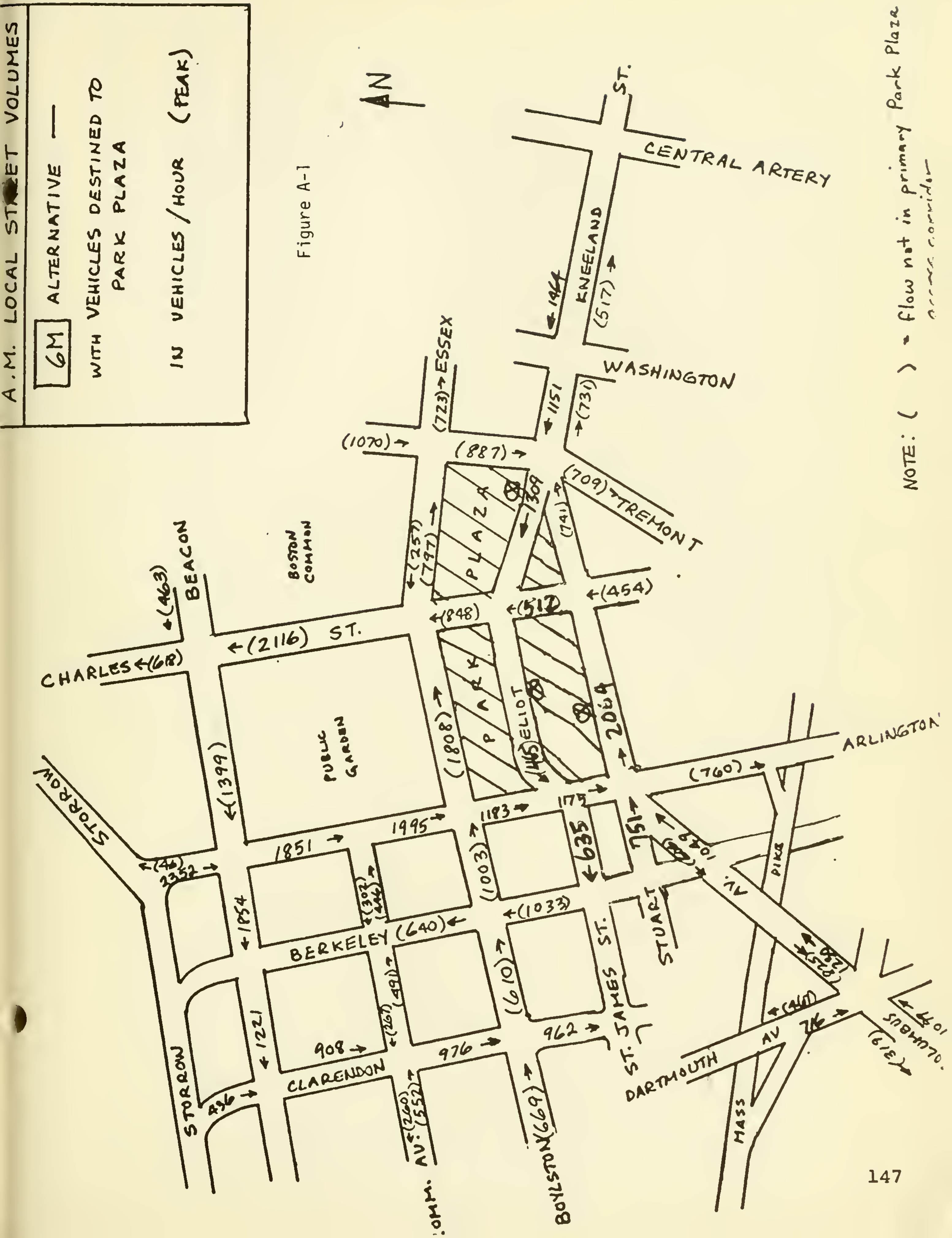


Figure A-1

A.M. LOCAL STREET VOLUMES
6M ALTERNATIVE —
WITH VEHICLES DESTINED TO PARK PLAZA
IN VEHICLES/HOUR (PEAK)
N
NOTE: ( ) = flow not in primary Park Plaza access corridor
CENTRAL ARTERY
ST.
KNEELAND
1464
(517)
WASHINGTON
1151
(731)
ESSEX
(723)
(1070)
(887)
(709)
TREMONT
(741)
309
PLAZA
PARK
(257)
(797)
BOSTON COMMON
(454)
(512)
(848)
BEACON
(463)
(2116) ST.
CHARLES
(618)
PUBLIC GARDEN
(1808)
ELIOT
(445)
2064
ARLINGTON
(760)
STORROW
(1399)
(46)
2352
1851
1995
1183
175
635
751
1049
PIKE
AV.
(1003)
(302)
(446)
1854
BERKELEY
(640)
(1033)
ST. JAMES ST.
STUART
(491)
(261)
(610)
(520)
(289)
1221
908
976
962
(340)
716
DARTMOUTH
AV
MASS
CLARENDON
436
COMM. AV.
(260)
(552)
BOYLSTON
(669)
1074
(319)
COLUMBUS

P.M. LOCAL STREET VOLUMES

6M ALTERNATIVE — WITH VEHICLES ORIGINATING AT PARK PLAZA

IN VEHICLES/HOUR (PEAK)

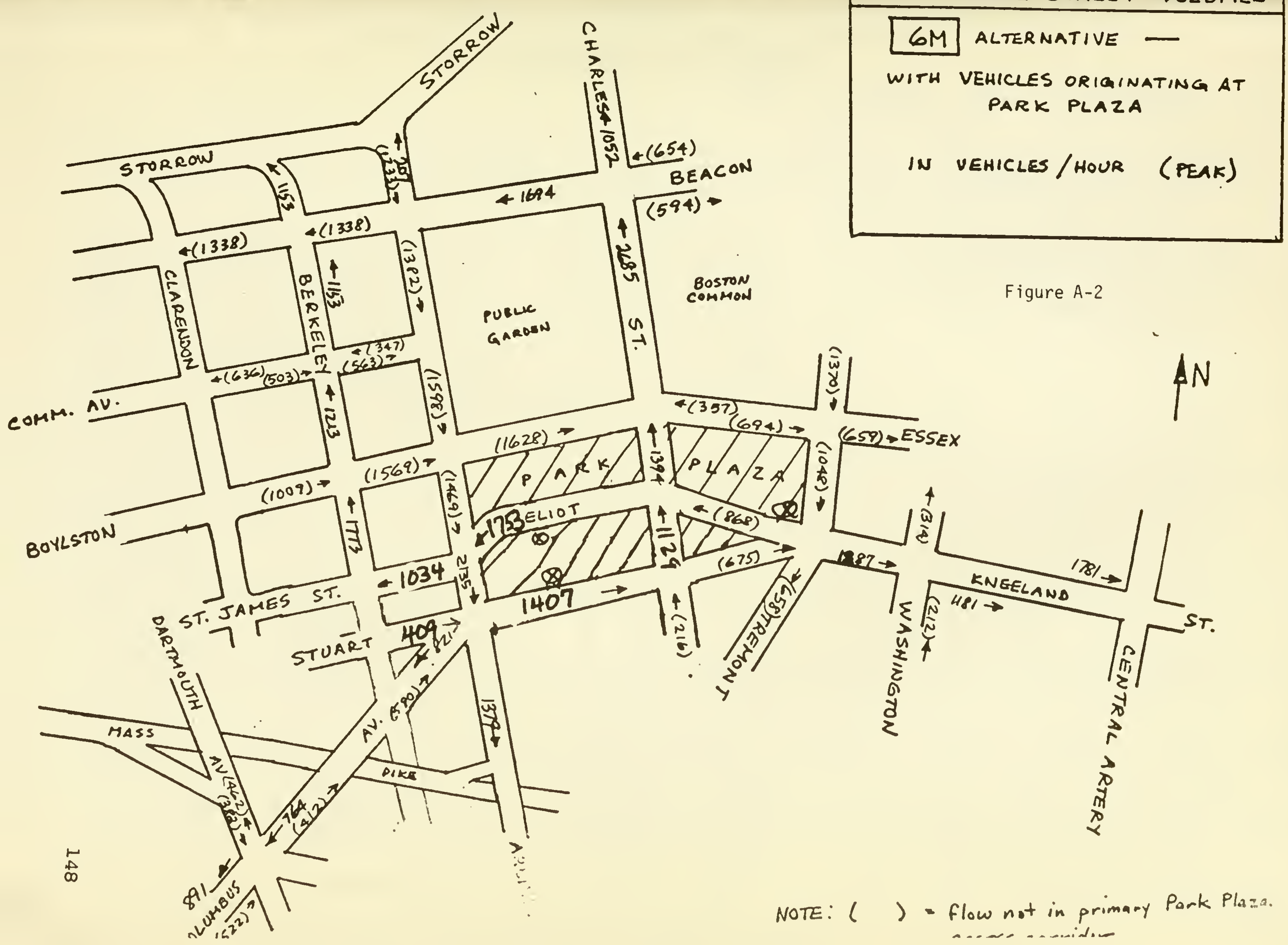


Figure A-2

NOTE: ( ) = flow not in primary Park Plaza access corridor

TABLE A-1

A.M. Peak Hour Street Volumes-Vehicles Destined to Park Plaza*
Six Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound	½ N	111	1141	9.7	1746	.72	.80
	Southbound	NW	91	345	26.3	876	.50	.54
Beacon-Arlington	Southbound	½ N	111	834	13.3	1440	.66	.73
	Westbound	½ N	111	1296	8.6	1680	.84	.94
Boylston - Clarendon	Southbound	NW, ½ N	202	624	32.4	1104	.75	.79
Boylston - Arlington	Southbound	½ N	111	1683	6.6	2208	.81	.92
Columbus-Arlington-Stuart	Southbound	½ N	111	989	11.2	816	1.35	1.50
	Eastbound	½ N, NW	202	450	44.9	420	1.55	1.62
	Northeast bound	SW, W	540	509	106.1	504	2.08	2.02
Washington - Stuart	Eastbound	NE, SE	599	654	91.6	1272	.99	.97
Dartmouth - Columbus	Southeast bound	W	276	440	62.7	552	1.29	1.32
	Northeast bound	SW	264	835	31.7	900	1.22	1.30
Commonwealth-Arlington	Southbound	½ N	111	1512	7.3	2160	.75	.85

(1) See Route Map for Corridor Location and Routing Through Intersections

P.M. Peak Hour Street Volumes-Vehicles Destined to Park Plaza*

Six Million Sq. Ft. Alternative

			[1]	[2]	[1]/[2]	[3]	([1]+[2])/[3]	
Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles	Existing Volume	% Added	Capacity (Veh/Hr)	Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	122	810	15.1	816	1.14	1.26
Beacon-Charles	Northbound	N	243	1615	15.0	2460	.76	.83
Boylston-Charles	Northbound	N	243	1004	24.2	1494	.83	.90
Columbus-Arlington-Stuart	Westbound	W, SW	666	530	125.6	816	1.47	1.40
Washington - Stuart	Eastbound	SE, NE	752	562	133.8	1488	.88	.84
Dartmouth-Columbus	Southwest bound	SW	327	437	74.8	756	1.01	1.01
Arlington - Mass Pike	Southbound	W	339	1416	23.9	2230	.79	.85
Beacon - Berkeley	Northbound	NW	113	1040	10.9	1104	1.04	1.17

(1) See route maps for corridor routings through intersections.

TABLE A-3

A.M. Peak Hour Transit Volumes-Trips Destined to Park Plaza

Six Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	637	7321	7958	8.7	16,000	.56
Green (No. Sta.)	NW,SE,NE, .2 DNTN	1131	7300	8431	15.5	16,000	.58
Red (Harvard)	NW	305	7379	7684	4.1	20,900	.42
Red(So.Shore)	SE	464	11335	11799	4.1	20,900	.64
Blue	NE	396	7475	7871	5.3	10,000	.89
Orange (Hay)	N	401	6125	6526	6.5	11,900	.62
Orange (Forest Hill)	SW	514	8478	8992	6.1	11,900	.85

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-4

P.M. Peak Hour Transit Volumes-Trips Destined to Park Plaza

Six Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	1140	8100	9240	14.1	16,000	.64
Green (No. Sta.)	NW,SE, NE, .2 DNTN	1781	8100	9881	22.0	16,000	.67
Red (Harvard)	NW	379	9189	10198	3.9	20,900	.52
Red(So.Shore)	SE	585	13116	13701	4.5	20,900	.74
Blue	NE	486	7788	8274	6.2	10,000	.93
Orange (Hay)	N	472	7245	7717	6.5	11,900	.73
Orange (Forest Hill)	SW	637	9809	10446	6.5	11,900	.99

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE B-1

Parking Garage Demand Analysis

6M Alternative

Vehicle Occupancy by Time of Day

Activity Type	No. Veh	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	2242	0	1570	2018	2242	1682	673	0
Non-Employees	2002	0	200	200	600	500	300	200
Hotel	400	400	240	80	120	200	200	400
Residents	800	800	480	320	320	560	640	800
Total Demand	5444	1200	2490	2618	3282	2942	1813	1400
No. Parking Spaces Available		3131	3131	3131	3131	3131	3131	3131
Excess (+) or Deficiency (-)		+1931	+641	+513	-151	+189	+1318	+1731

FIVE MILLION ALTERNATIVE

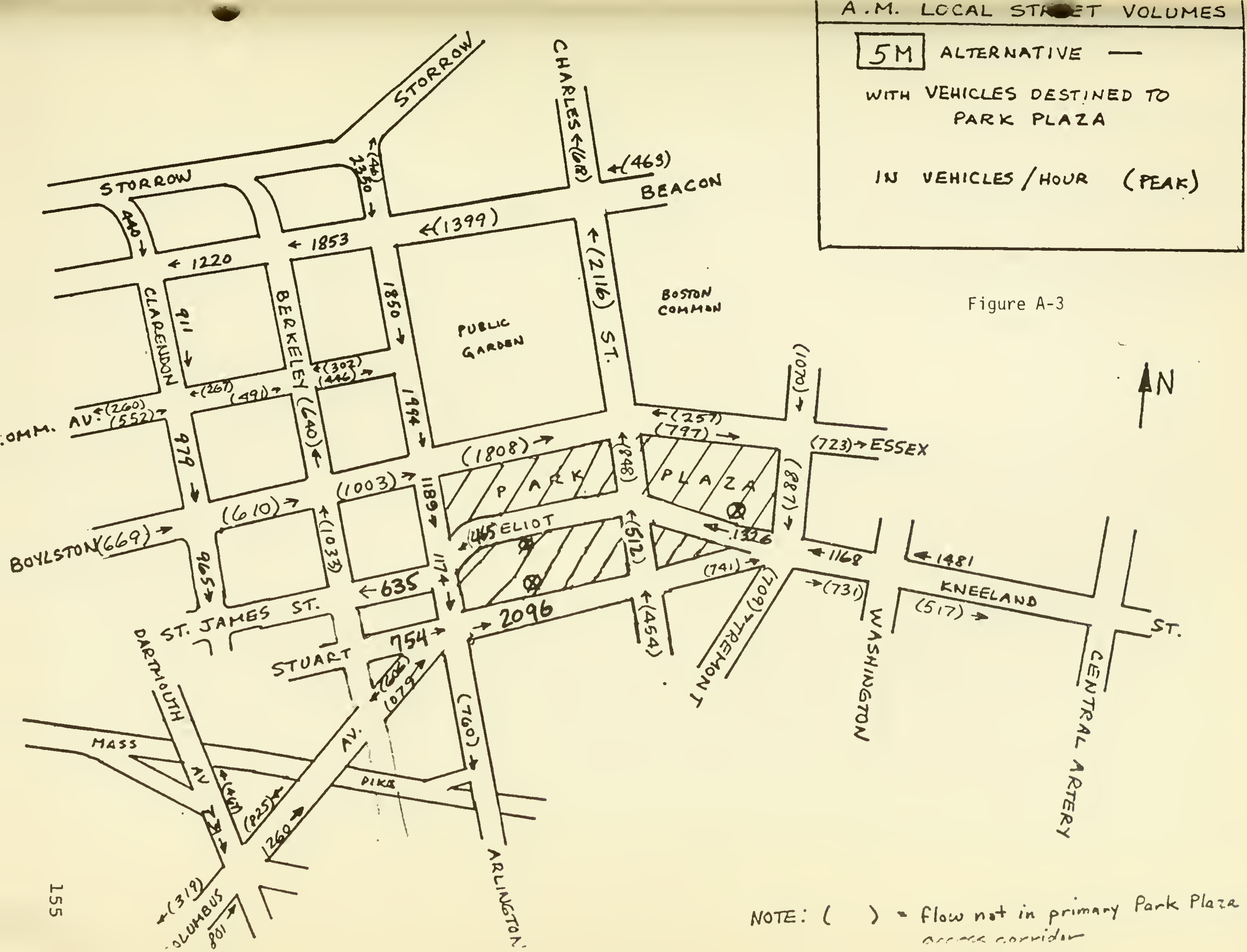


Figure A-3

NOTE: ( ) = flow not in primary Park Plaza access corridor

P.M. LOCAL STREET VOLUMES

5M ALTERNATIVE —

WITH VEHICLES ORIGINATING AT PARK PLAZA

IN VEHICLES/HOUR (PEAK)

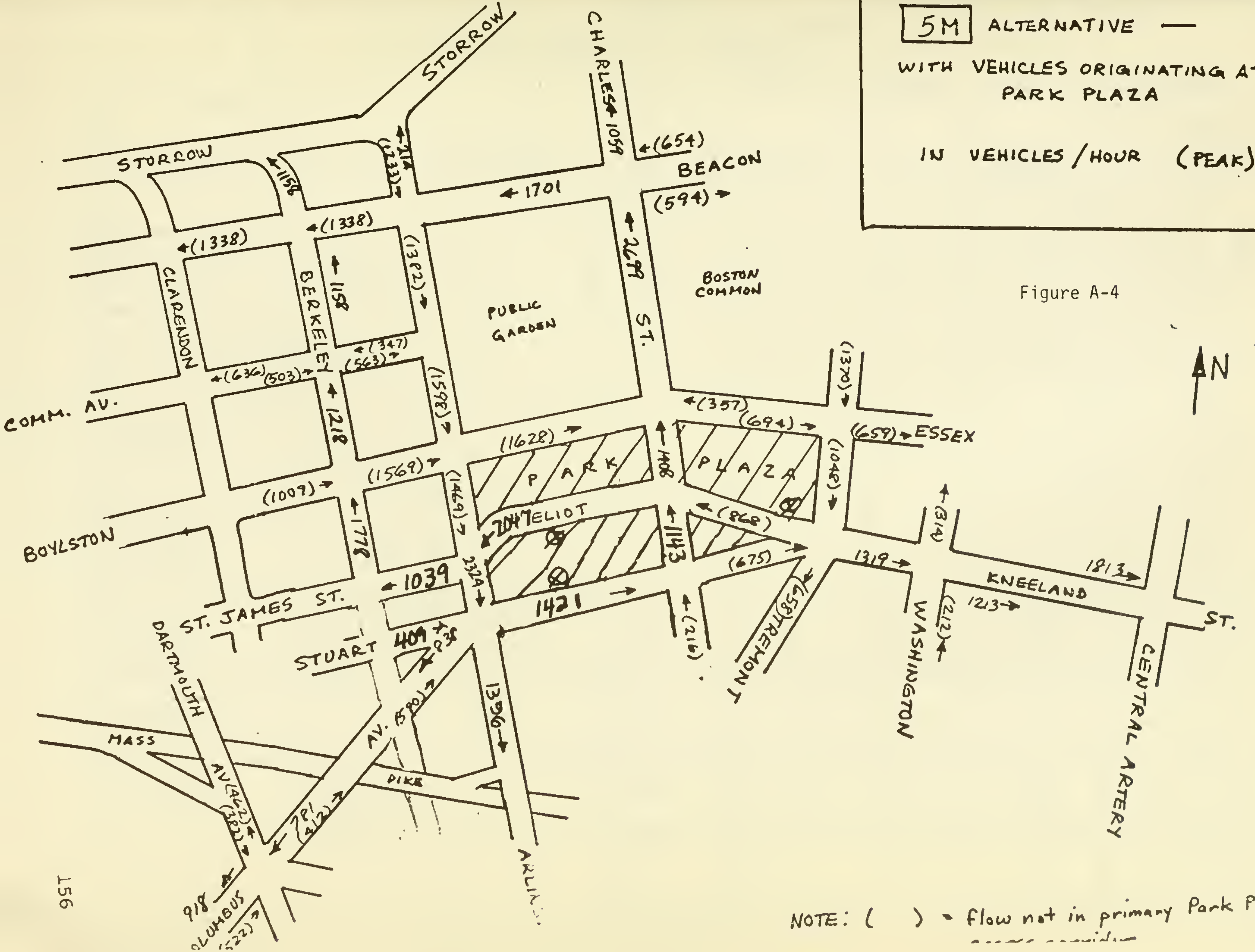


Figure A-4

NOTE: ( ) - flow not in primary Park Plaza

TABLE A-5

A.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*
Five Million Sq. Ft. Alternative

			[1]	[2]	[1]/[2]	[3]	([1]+[2])/[3]	
Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles	Existing Volume	% Added	Capacity (Veh/Hr)	Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound	½ N	110	1141	9.6	1746	.72	.80
	Southbound	NW	95	345	27.5	876	.50	.54
Beacon-Arlington	Southbound	½ N	110	834	13.1	1440	.66	.73
	Westbound	½ N	110	1296	8.5	1680	.84	.94
Boylston - Clarendon	Southbound	NW, ½ N	205	624	32.9	1104	.75	.80
Boylston - Arlington	Southbound	½ N	110	1683	6.5	2208	.81	.92
Columbus-Arlington-Stuart	Southbound	½ N	110	989	11.1	816	1.35	1.50
	Eastbound	½ N, NW	205	450	45.5	420	1.56	1.62
	Northeast bound	SW, W	570	509	111.9	504	2.14	2.07
Washington-Stuart	Eastbound	NE, SE	616	654	94.2	1272	1.00	.98
Dartmouth-Columbus	Southeast bound	W	291	440	66.1	552	1.32	1.34
	Northeast bound	SW	279	835	33.4	900	1.24	1.32
Commonwealth-Arlington	Southbound	½ N	110	1512	7.3	2160	.75	.85

(1) See Route Map for Corridor Location and Routing Through Intersections

TABLE A-6

P.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*
Five Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	129	810	15.9	816	1.15	1.27
Beacon-Charles	Northbound	N	257	1615	15.9	2460	.76	.84
Boylston-Charles	Northbound	N	257	1004	25.6	1494	.84	.91
Columbus-Arlington-Stuart	Westbound	W, SW	855	530	161.3	816	1.69	1.59
Washington-Stuart	Eastbound	SE, NE	784	562	139.5	1488	.90	.86
Dartmouth-Columbus	Southwest bound	SW	344	437	78.7	756	1.03	1.03
Arlington-Mass Pike	Southbound	W	356	1416	25.1	2230	.79	.86
Beacon-Berkeley	Northbound	NW	118	1040	11.3	1104	1.05	1.17

(1) See route maps for corridor routings through intersections.

TABLE A-7

A.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza
Five Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	700	7321	8021	9.6	16,000	.56
Green (No. Sta.)	NW,SE,NE, .2 DNTN	1411	7300	8711	19.3	16,000	.60
Red (Harvard)	NW	320	7379	7699	4.3	20,900	.42
Red(So.Shore)	SE	487	11335	11822	4.3	20,900	.64
Blue	NE	389	7475	7864	5.2	10,000	.89
Orange (Hay)	N	420	6125	6545	6.9	11,900	.62
Orange (Forest Hill)	SW	542	8478	9020	6.4	11,900	.86

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-8

P.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza
Five Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	1150	8100	9250	14.2	16,000	.64
Green (No. Sta.)	NW,SE,NE, .2 DNTN	1854	8100	9954	22.9	16,000	.68
Red (Harvard)	NW	398	9189	9587	4.3	20,900	.52
Red(So.Shore)	SE	612	13116	13728	4.7	20,900	.75
Blue	NE	508	7788	8296	6.5	10,000	.94
Orange (Hay)	N	498	7245	7743	6.9	11,900	.73
Orange (Forest Hill)	SW	669	9809	10478	6.8	11,900	.99

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE B-2

Parking Garage Demand Analysis

5M Alternative
Vehicle Occupancy by Time of Day

Activity Type	No.Veh.	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	2301	0	1611	2071	2301	1726	690	0
Non-Employees	2087	0	209	209	626	522	313	209
Hotel	406	406	244	81	122	203	203	406
Residents	542	542	325	217	217	379	434	542
Total Demand		948	1939	2578	3266	2830	1640	1157
No. Parking Spaces Available		2056	2056	2056	2056	2056	2056	2056
Excess (+) or Deficiency (-)		+1108	+ 117	-552	-1210	- 774	+416	+899

FOUR MILLION ALTERNATIVE

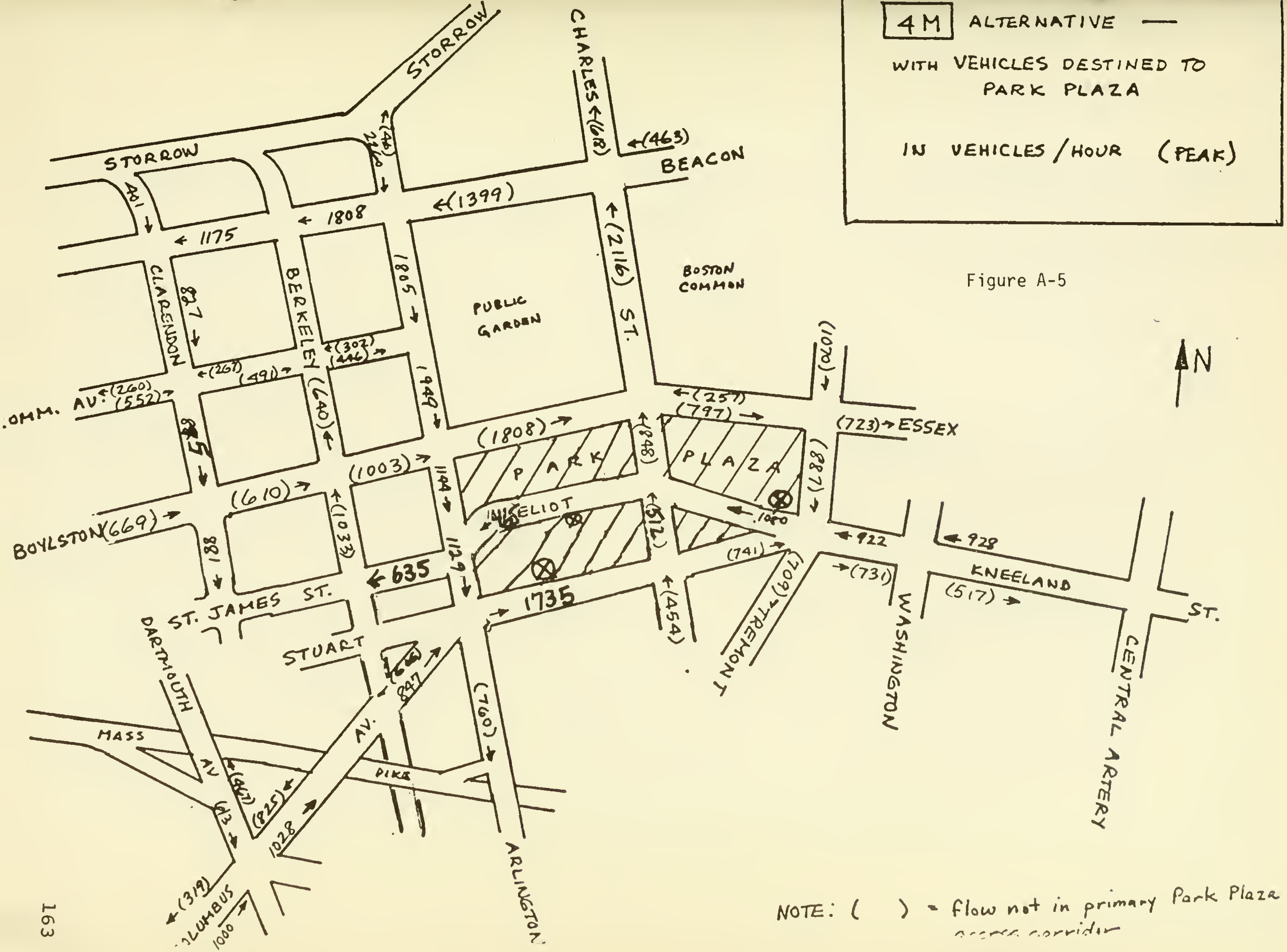
A.M. LOCAL STR T VOLUMES

4M ALTERNATIVE —

WITH VEHICLES DESTINED TO
PARK PLAZA

IN VEHICLES / HOUR (PEAK)

Figure A-5



NOTE: ( ) = flow not in primary Park Plaza access corridor

P.M. LOCAL STREET VOLUMES

4M ALTERNATIVE —

WITH VEHICLES ORIGINATING AT PARK PLAZA

IN VEHICLES/HOUR (PEAK)

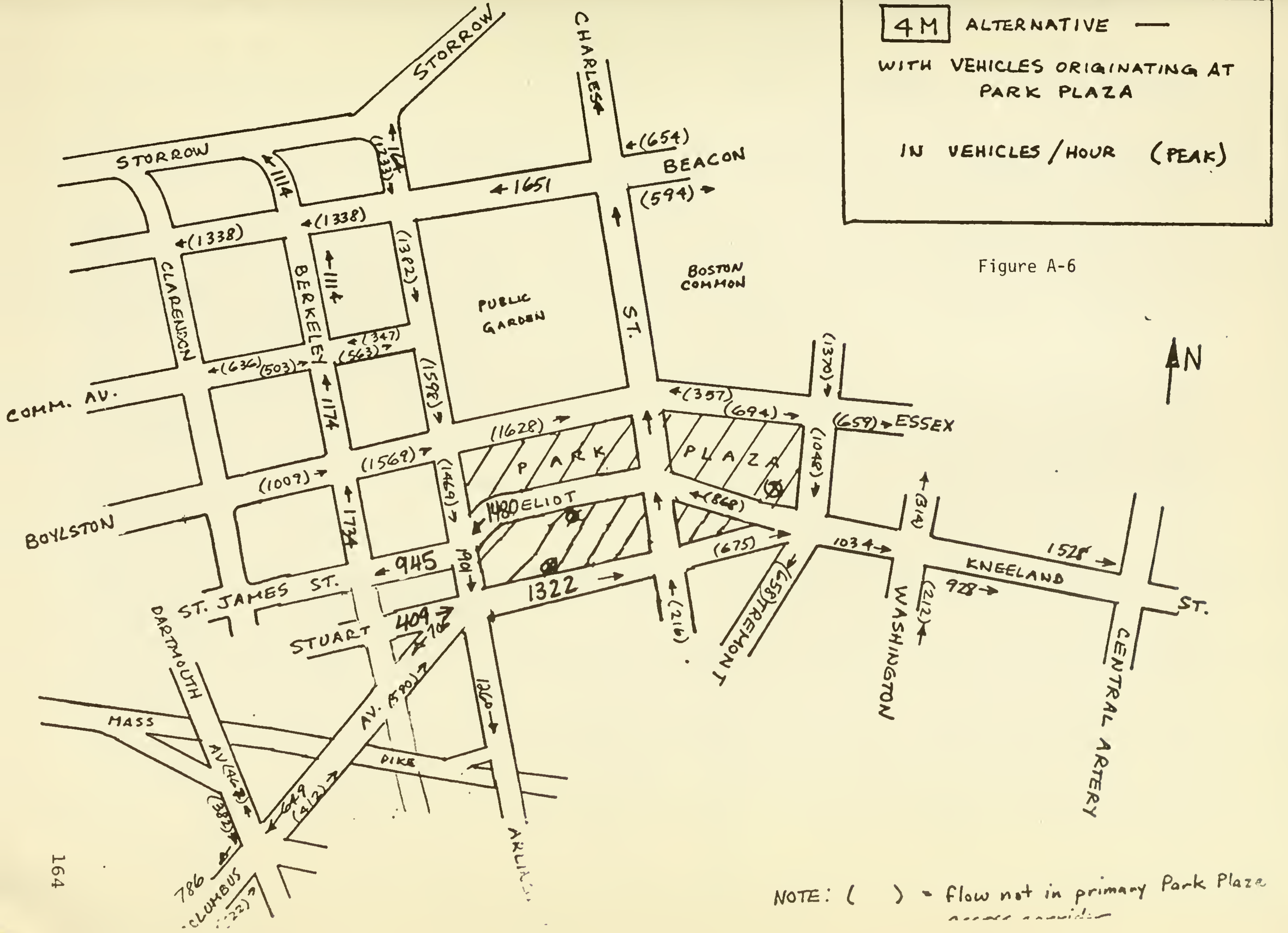


Figure A-6

NOTE: ( ) = flow not in primary Park Plaza access corridor

TABLE 9

A.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*

Four Million Sq. Ft. Alternative

			[1]	[2]	[1]/[2]	[3]	([1] +[2])/[3]	
Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles	Existing Volume	% Added	Capacity (Veh/Hr)	Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound Southbound	½ N NW	65 56	1141 345	5.7 16.2	1746 876	.69 .46	.78 .50
Beacon-Arlington	Southbound Westbound	½ N ½ N	65 65	834 1296	7.8 5.0	1440 1680	.62 .81	.70 .92
Boylston-Clarendon	Southbound	NW, ½ N	121	624	19.4	1104	.67	.74
Boylston-Arlington	Southbound	½ N	65	1683	3.9	2208	.79	.90
Columbus-Arlington-Stuart	Southbound Eastbound Northeast bound	½ N ½ N, NW SW, W	65 121 338	989 450 509	6.6 26.9 66.4	816 420 504	1.29 1.36 1.68	1.46 1.46 1.70
Washington-Stuart	Eastbound	NE, SE	370	654	56.6	1272	.81	.82
Dartmouth-Columbus	Southeast bound Northeast bound	W SW	173 165	440 835	39.3 19.8	552 900	1.11 1.11	1.17 1.21
Commonwealth-Arlington	Southbound	½ N	65	1512	4.3	2160	.73	.83

(1) See Route Map for Corridor Location and Routing Through Intersections

TABLE

P.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*

Four Million Sq. Ft. Alternative

			[1]	[2]	[1]/[2]	[3]	([1]+[2])/[3]	
Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles	Existing Volume	% Added	Capacity (Veh/Hr)	Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	79	810	9.8	816	1.09	1.22
Beacon-Charles	Northbound	N	158	1615	9.8	2460	.72	.81
Boylston-Charles	Northbound	N	158	1004	15.7	1494	.78	.86
Columbus-Arlington-Stuart	Westbound	W, SW	432	530	81.5	816	1.18	1.17
Washington-Stuart	Eastbound	SE, NE	499	562	88.8	1488	.71	.70
Dartmouth-Columbus	Southwest bound	SW	212	437	48.5	756	.86	.89
Arlington-Mass Pike	Southbound	W	220	1416	15.5	2230	.73	.81
Beacon-Berkeley	Northbound	NW	74	1040	7.1	1104	1.01	1.14

(1) See route maps for corridor routing through intersections.

TABLE A-11

A.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza

Four Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	453	7321	7774	6.2	16,000	.55
Green (No. Sta.)	NW,SE,NE, .2 DNTN	857	7300	8157	11.7	16,000	.57
Red (Harvard)	NW	190	7379	7569	2.6	20,900	.41
Red(So.Shore)	SE	289	11335	11624	2.5	20,900	.64
Blue	NE	240	7475	7715	3.2	10,000	.88
Orange (Hay)	N	249	6125	6374	4.1	11,900	.61
Orange (Forest Hill)	SW	321	8478	8799	3.8	11,900	.84

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-12

P.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza

Four Million Sq. Ft. Alternative

		(1)	(2)	(1)+(2)	(1)/(2)	(3)	
Line	Access Corridors Using This Line	Total Park Plaza Trips	Existing Volume	Total Volume	% Added	Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	815	8100	8915	9.1	16,000	.62
Green (No. Sta.)	NW,SE,NE, .2 DNTN	1200	8100	9300	12.9	16,000	.64
Red (Harvard)	NW	247	9189	9436	2.7	20,900	.52
Red(So.Shore)	SE	380	13116	13496	2.9	20,900	.74
Blue	NE	338	7788	8126	4.3	10,000	.92
Orange (Hay)	N	308	7245	7553	4.3	11,900	.72
Orange (Forest Hill)	SW	414	9809	10223	4.2	11,900	.98

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

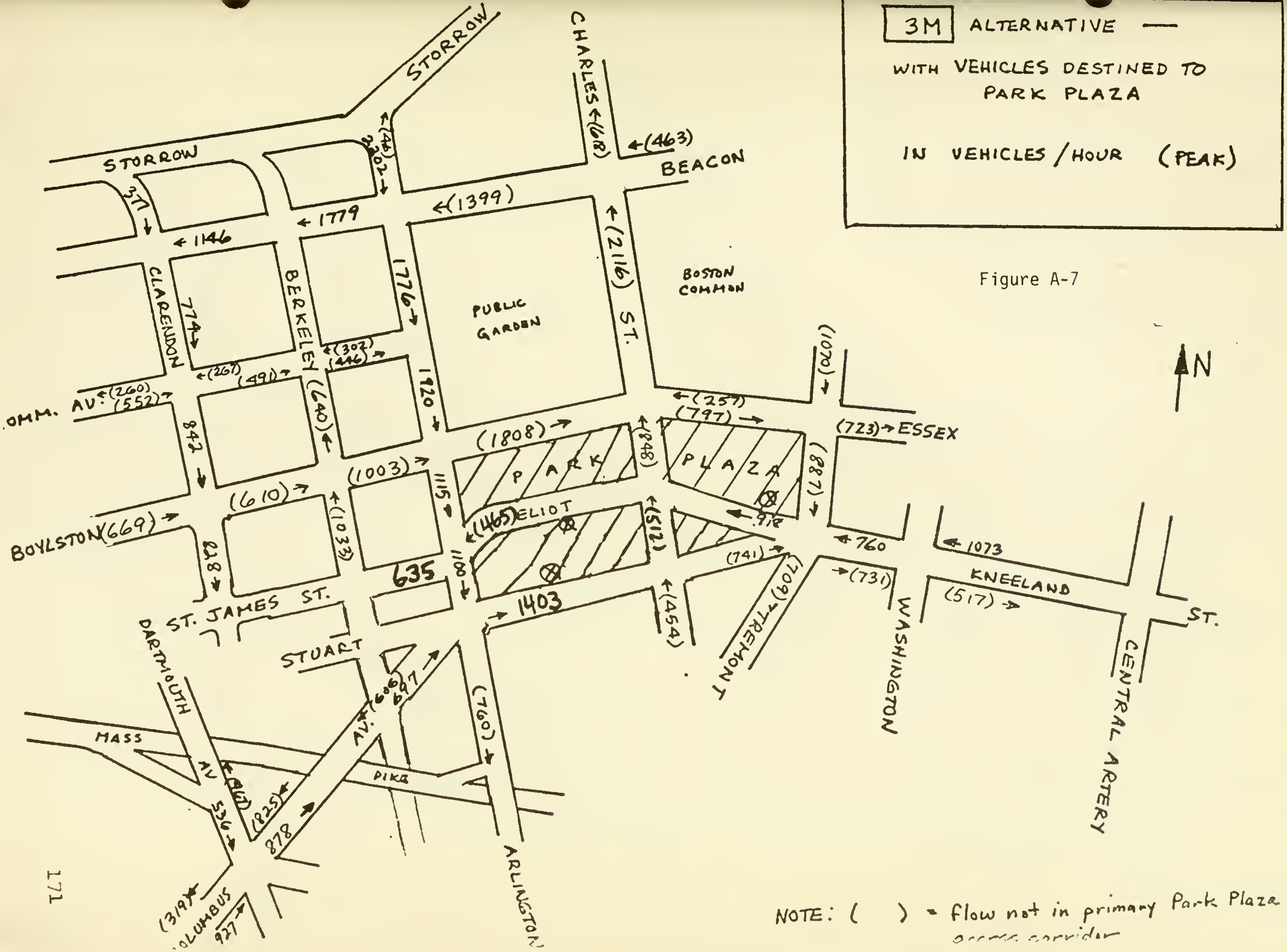
TABLE B-3

Parking Garage Demand Analysis

4M Alternative
Vehicle Occupancy by Time of Day

Activity Type	No.Veh.	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	1703	0	1192	1533	1703	1277	511	0
Non-Employees	1613	0	161	161	484	403	242	161
Hotel	406	406	244	81	122	203	203	406
Residents	995	995	597	398	398	697	796	995
Total Demand		1401	2194	2173	2707	2580	1752	1562
No. Parking Spaces Available		1575	1575	1575	1575	1575	1575	1575
Excess (+) or Deficiency (-)		+174	-619	-598	-1132	-1005	-177	+ 13

THREE MILLION ALTERNATIVE



3M ALTERNATIVE —

WITH VEHICLES DESTINED TO PARK PLAZA

IN VEHICLES / HOUR (PEAK)

Figure A-7

NOTE: ( ) = flow not in primary Park Plaza access corridor

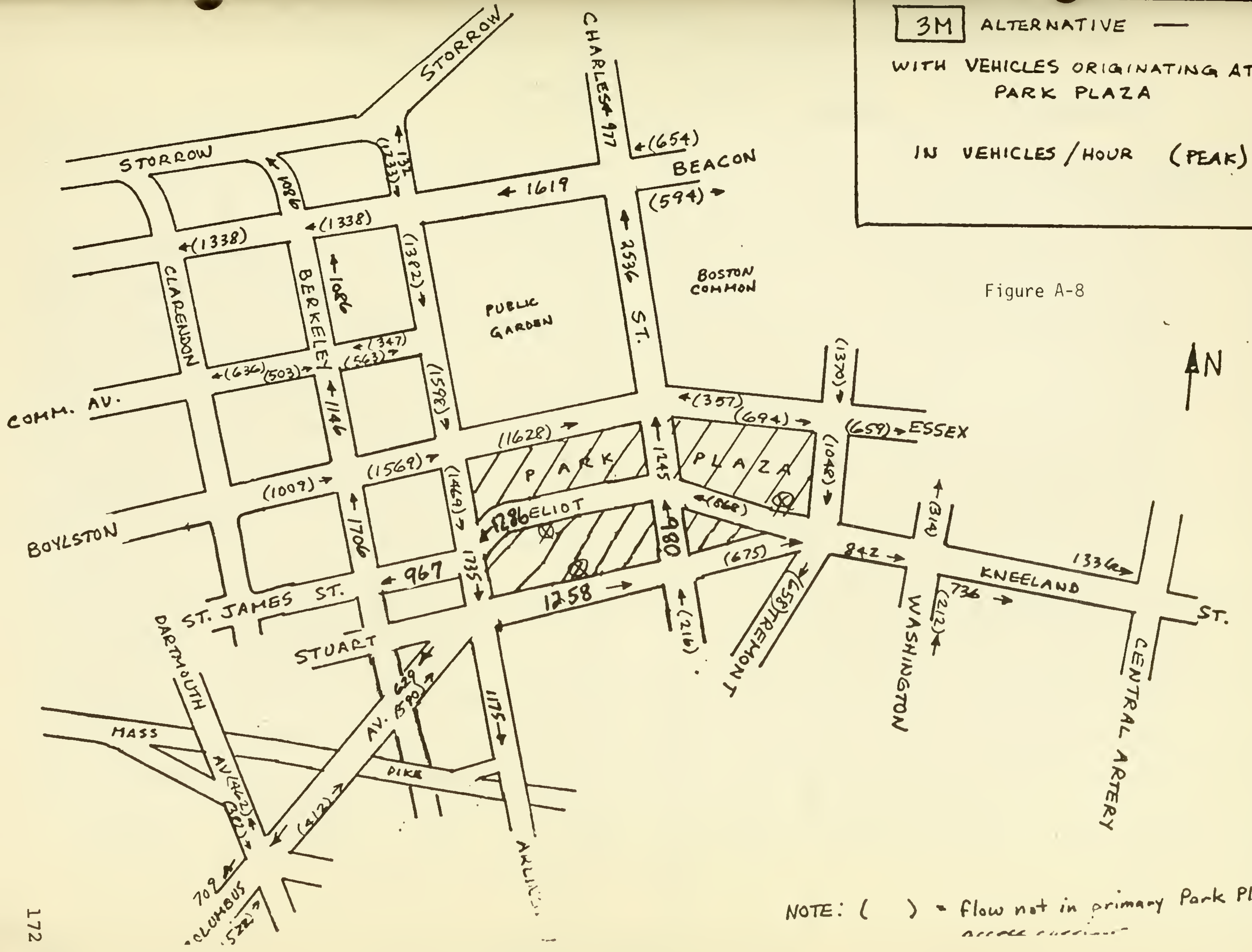
LOCAL STREET VOLUMES

3M ALTERNATIVE —

WITH VEHICLES ORIGINATING AT PARK PLAZA

IN VEHICLES / HOUR (PEAK)

Figure A-8



NOTE: ( ) = flow not in primary Park Plaza access corridors

TABLE A-13

A.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*

Three Million Sq. Ft. Alternative

			[1]	[2]	[1]/[2]	[3]	([1]+[2])/[3]	
Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles	Existing Volume	% Added	Capacity (Veh/Hr)	Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound Southbound	½ N NW	36 32	1141 345	3.2 9.3	1746 876	.67 .43	.77 .48
Beacon-Arlington	Southbound Westbound	½ N ½ N	36 36	834 1296	4.3 2.8	1440 1680	.60 .79	.69 .90
Boylston-Clarendon	Southbound	NW, ½ N	68	624	10.9	1104	.63	.70
Boylston-Arlington	Southbound	½ N	36	1683	2.1	2208	.78	.89
Columbus-Arlington-Stuart	Southbound Eastbound Northeast bound	½ N ½ N, NW SW, W	36 68 188	989 450 509	3.6 15.1 36.9	816 420 504	1.26 1.23 1.38	1.43 1.36 1.46
Washington-Stuart	Eastbound	NE, SE	208	654	31.8	1272	.68	.72
Dartmouth-Columbus	Southeast bound Northeast bound	W SW	96 92	440 835	21.8 11.0	552 900	.97 1.03	1.06 1.15
Commonwealth-Arlington	Southbound	½ N	36	1512	2.4	2160	.72	.82

(1) See Route Map for Corridor Location and Routing Through Intersections

TABLE A-14

P.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*
Three Million Sq. Ft. Alternative

			[1]	[2]	[1]/[2]	[3]	([1]+[2])/[3]	
Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles	Existing Volume	% Added	Capacity (Veh/Hr)	Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	47	810	5.8	816	1.05	1.19
Beacon-Charles	Southbound	N	94	1615	5.8	2460	.69	.79
Boylston-Charles	Southbound	N	94	1004	9.4	1494	.73	.82
Columbus-Arlington-Stuart	Southbound	W, SW	266	530	50.0	816	.98	1.01
Washington-Stuart	Eastbound	SE, NE	307	562	54.6	1488	.58	.60
Dartmouth-Columbus	Southwest bound	SW	131	437	30.0	756	.75	.80
Arlington-Mass Pike	Southbound	W	135	1416	9.5	2230	.70	.78
Beacon-Berkeley	Northbound	NW	46	1040	4.4	1104	.98	1.12

(1) See route maps for corridor routings through intersections.

TABLE A-15

A.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza
Three Million Sq. Ft. Alternative

		(1)	(2)	(1)+(2)	(1)/(2)	(3)	
Line	Access Corridors Using This Line	Total Park Plaza Trips	Existing Volume	Total Volume	% Added	Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	325	7321	7646	4.4	16,000	.54
Green (No. Sta.)	NW,SE, NE .2 DNTN	498	7300	7798	6.8	16,000	.55
Red (Harvard)	NW	108	7379	7487	1.4	20,900	.41
Red(So.Shore)	SE	163	11335	11498	1.4	20,900	.63
Blue	NE	132	7475	7607	1.8	10,000	.87
Orange (Hay)	N	137	6125	6262	2.2	11,900	.60
Orange (Forest Hill)	SW	180	8478	8658	2.1	11,900	.83

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-16

P.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza

Three Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	562	8100	8662	6.5	16,000	.61
Green (No. Sta.)	NW,SE,NE .2 DNTN	592	8100	8692	7.3	16,000	.61
Red (Harvard)	NW	154	9189	9343	1.6	20,900	.51
Red(So.Shore)	SE	238	13116	13354	1.8	20,900	.73
Blue	NE	200	7788	7988	2.6	10,000	.91
Orange (Hay)	N	184	7245	7429	2.3	11,900	.71
Orange (Forest Hill)	SW	257	9809	10066	2.6	11,900	.97

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE B-4

Parking Garage Demand Analysis

3M Alternative

Vehicle Occupancy by Time of Day

Activity Type	No.Veh.	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	1370	0	959	1233	1370	1028	411	0
Non-Employees	1746	0	175	175	524	437	262	175
Hotel	203	203	122	41	61	102	102	203
Residents	750	750	450	300	300	525	600	750
Total Demand		953	1706	1749	2255	2092	1375	1128
No. Parking Spaces Available		1395	1395	1395	1395	1395	1395	1395
Excess ( ) or Deficiency (-)		+442	-311	-354	-860	-697	+ 20	+267

TWO MILLION ALTERNATIVE

2M ALTERNATIVE —

WITH VEHICLES DESTINED TO PARK PLAZA

IN VEHICLES / HOUR (PEAK)

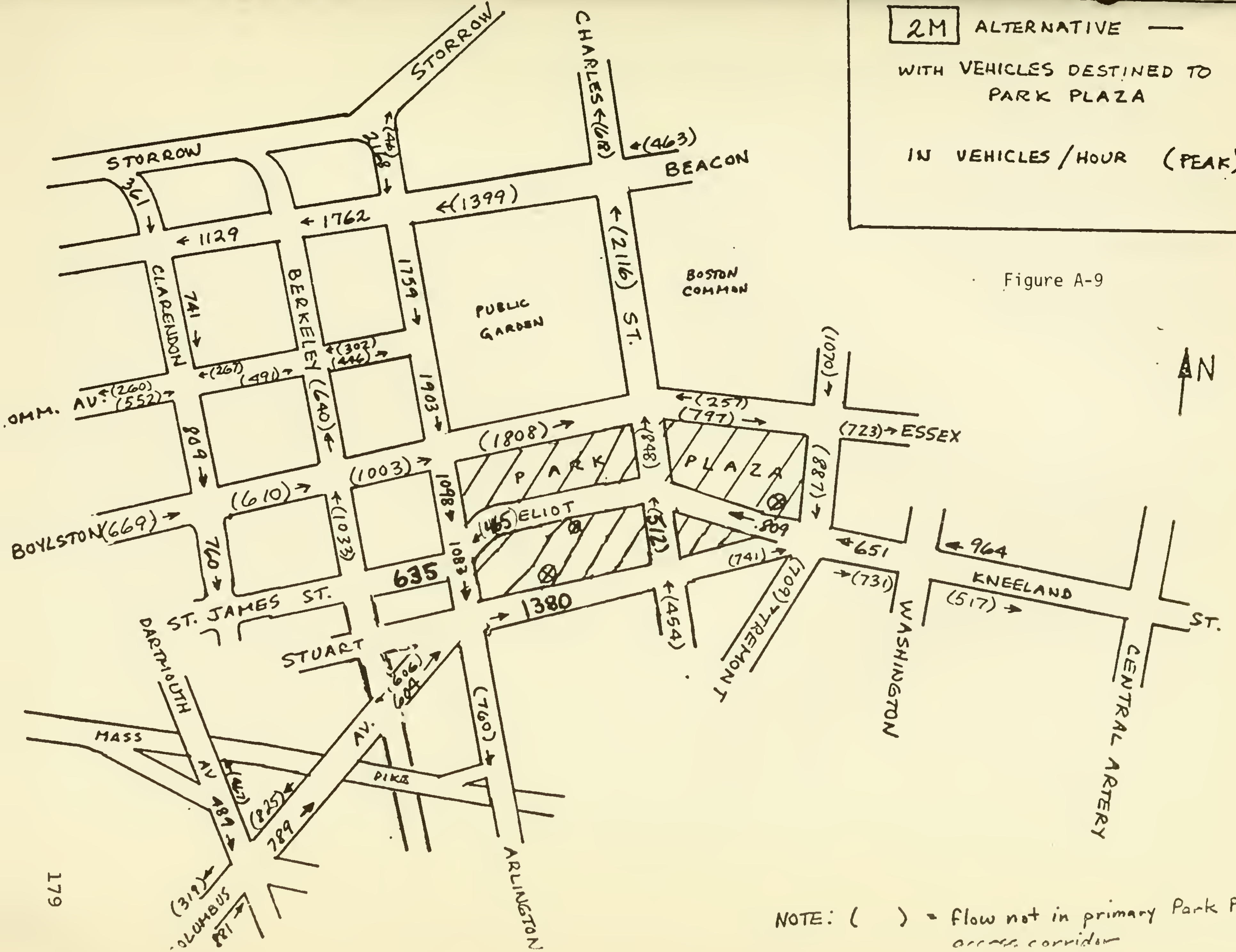


Figure A-9

NOTE: ( ) = flow not in primary Park Plaza access corridor

P.M. LOCAL STR[illegible]T VOLUMES

2M ALTERNATIVE —

WITH VEHICLES ORIGINATING AT PARK PLAZA

IN VEHICLES / HOUR (PEAK)

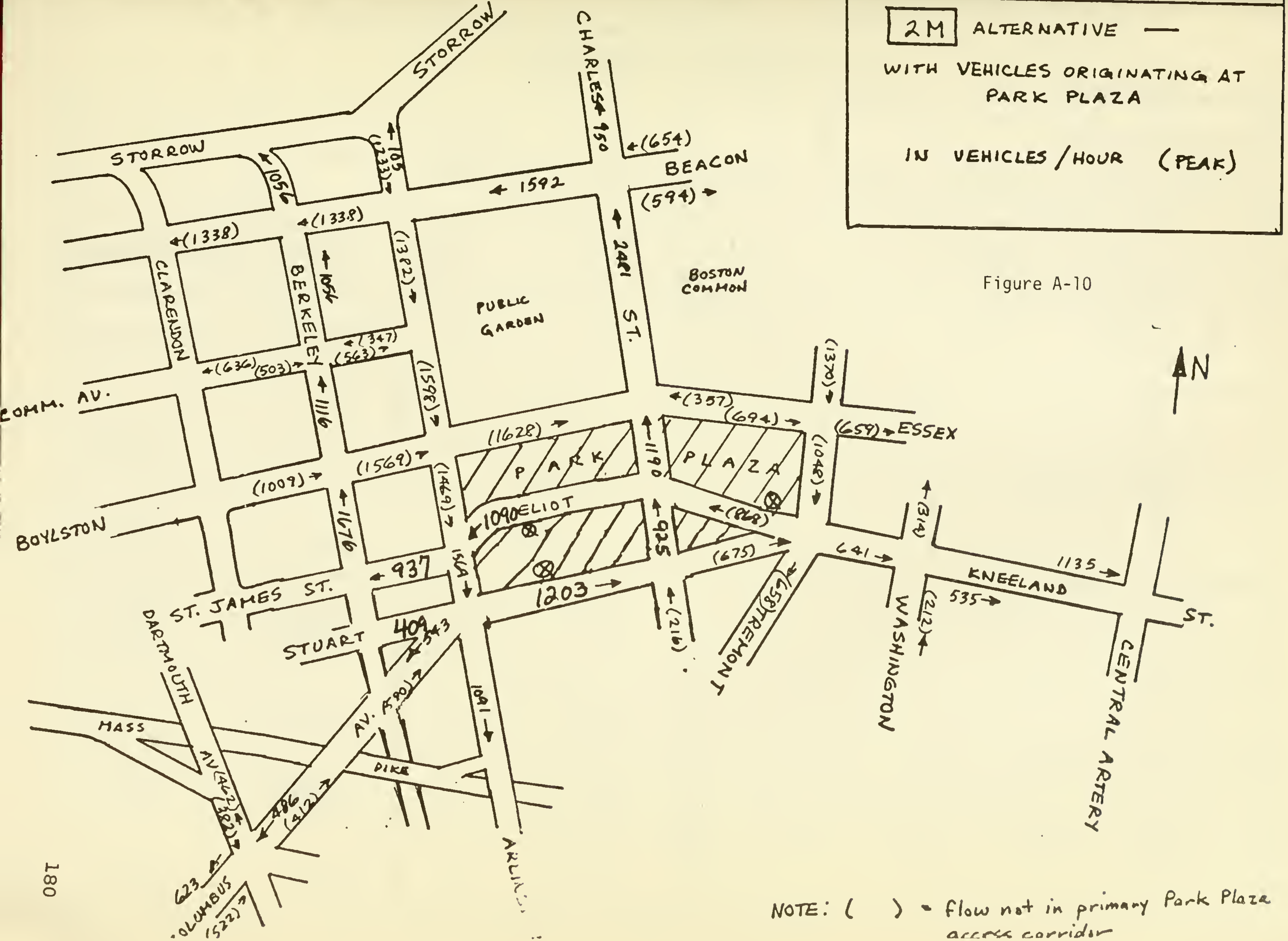


Figure A-10

NOTE: ( ) = flow not in primary Park Plaza access corridor

TABLE A-17

A.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*

Two Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound	½ N	19	1141	1.7	1746	.66	.76
	Southbound	NW	16	345	4.6	876	.41	.47
Beacon-Arlington	Southbound	½ N	19	834	2.3	1440	.59	.68
	Westbound	½ N	19	1296	1.5	1680	.78	.90
Boylston-Clarendon	Southbound	NW, ½ N	35	624	5.6	1104	.60	.68
Boylston-Arlington	Southbound	½ N	19	1683	1.1	2208	.77	.88
Columbus-Arlington-Stuart	Southbound	½ N	19	989	1.9	816	1.24	1.41
	Eastbound	½ N, NW	35	450	7.8	420	1.15	1.30
	Northeast bound	SW, W	95	509	18.7	504	1.20	1.31
Washington-Stuart	Eastbound	NE, SE	99	654	15.1	1272	.59	.65
Dartmouth-Columbus	Southeast bound	W	49	440	11.1	552	.89	.99
	Northeast bound	SW	46	835	5.5	900	.98	1.11
Commonwealth-Arlington	Southbound	½ N	19	1512	1.3	2160	.71	.81

(1) See Route Map For Corridor Location and Routing Through Intersections.

TABLE A-18

P.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*
Two Million Sq. Ft. Alternative

			[1]	[2]	[1]/[2]	[3]	([1] +[2])/[3]	
Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles	Existing Volume	% Added	Capacity (Veh/Hr)	Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	20	810	2.5	816	1.02	1.16
Beacon-Charles	Northbound	N	39	1615	2.4	2460	.67	.77
Boylston-Charles	Northbound	N	39	1004	3.9	1494	.70	.79
Columbus-Arlington-Stuart	Westbound	W, SW	100	530	18.9	816	.77	.85
Washington-Stuart	Eastbound	SE, NE	106	562	18.9	1488	.45	.49
Dartmouth-Columbus	Southwest bound	SW	49	437	11.2	756	.64	.72
Arlington-Mass Pike	Southbound	W	51	1416	3.6	2230	.66	.75
Beacon-Berkeley	Northbound	NW	16	1040	1.5	1104	.96	1.10

(1) See route maps for corridor routing through intersections.

TABLE A-19

A.M. Peak Hour Transit Volume - Trips Destined to Park Plaza

Two Million Sq. Ft. Alternative

		(1)	.(2)	(1)+(2)	(1)/(2)	(3)	
Line	Access Corridors Using This Line	Total Park Plaza Trips	Existing Volume	Total Volume	% Added	Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	156	7321	7477	2.1	16,000	.53
Green (No. Sta.)	NW,SE,NE .2 DNTN	239	7300	7539	3.3	16,000	.54
Red (Harvard)	NW	53	7379	7432	0.7	20,900	.41
Red(So.Shore)	SE	80	11335	11415	0.7	20,900	.63
Blue	NE	61	7475	7536	0.8	10,000	.87
Orange (Hay)	N	71	6125	6196	1.1	11,900	.60
Orange (Forest Hill)	SW	90	8478	8568	1.0	11,900	.83

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-20

P.M. Peak Hour Transit Volume - Trips Destined to Park Plaza

Two Million Sq. Ft. Alternative

		(1)	(2)	(1)+(2)	(1)/(2)	(3)	
Line	Access Corridors Using This Line	Total Park Plaza Trips	Existing Volume	Total Volume	% Added	Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	295	8100	8395	3.6	16,000	.597
Green (No. Sta.)	NW,SE,NE .2 DNTN	289	8100	8389	3.6	16,000	.597
Red (Harvard)	NW	57	9189	9246	0.6	20,900	.508
Red(So.Shore)	SE	85	13116	13201	0.6	20,900	.725
Blue	NE	65	7788	7853	0.8	10,000	.901
Orange (Hay)	N	76	7245	7321	1.0	11,900	.705
Orange (Forest Hill)	SW	96	9809	9905	1.0	11,900	.954

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE B-5

Parking Garage Demand Analysis

2M Alternative

Vehicle Occupancy by Time of Day

Activity Type	No.Veh.	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	963	0	674	867	963	722	289	0
Non-Employees	87	0	9	9	26	22	13	9
Hotel	0	0	0	0	0	0	0	0
Residents	320	320	192	128	128	224	256	320
Total Demand		320	875	1004	1117	968	558	329
No. Parking Spaces Available		1400	1400	1400	1400	1400	1400	1400
Excess (+) or Deficiency (-)		+1080	+525	+396	+283	+432	+842	+1071

UTILITIES

- Utilities
- Energy

UTILITIES

1985 Park Plaza Water Demands

Table 3-II presents the average daily demands for the Park Plaza area for each of the alternatives.

Average daily demands are determined by multiplying the average daily per capita demand times the specific population being examined. Annual water consumption records, maintained by the Water Division of the City of Boston, indicate an average of MGD (Million Gallons/Day) increase per annum of the average daily demand since 1966 to present. Converted to the daily per capita rate, the 3 MGD represents a 2 GPCD (Gallons per Capita/Day) increase per annum for the nine-year period 1966-1975.

To determine the peaking factor applicable to Park Plaza, daily use data in the City of Boston was tabulated for the years 1940 through 1966. A peak hourly rate of flow of 198.8 MGD occurred in 1963. The average daily flow rate for that year was 121.3 MGD. Using Equation (2) a peaking factor of 1.64 was obtained.

$$\text{Peak Factor} = \frac{\text{Peak Hourly Consumption}}{\text{Average Daily Consumption}} \quad \ldots (2)$$

The peak factor of 1.64 represented approximately 700,000 residents. Using the curves presented in the TR-16 Manual of the "New England Interstate Water Pollution Control Commission", the City of Boston peaking factor was approximated using Equation (3).

$$PF = \frac{18 + P^{\frac{1}{2}}}{4 + P^{\frac{1}{2}}} \quad \ldots (3)$$

Where; P = Population in thousands

Applying the existing population figures for Park Plaza (8,093) the resultant peaking factor for the development site is approximately 3. This peak factor is in agreement with the design criteria standards for the City of Boston (Appendix A). The calculated peak flow then is three times the average daily flow shown in Table 3-II.

1985 Park Plaza HPFS Demands

Fire flow requirements as defined by the "National Board of Fire Underwriters (NBFU)" is given by Equation (4) below;

$$Q = (1010)\ (P)^{\frac{1}{2}}\ \ 1 - \frac{P^{\frac{1}{2}}}{100}$$

Where; Q = Rate of flow, gpm

P = Population in thousands

Applying Equation (4) to the approximate population of the proposed development site, a minimum of 2,900 gpm is required for the "no build" alternative and approximately 5,000 gpm for the 6 MSF alternate.

1985 Park Plaza Sanitary Sewer Demands

Table 3-III presents the estimated peak demands for the two development conditions examined. The estimated peak sanitary demand on the sewer systems servicing the Park Plaza area is approximately 8.2 MGD for the "no build" option and 11.8 MGD for the 6 MSF development.

For the "no build" option the 8.2 MGD is composed of about 1.8 MGD from the Project area and 6.4 MGD from the off-site tributary area. Table 3-IV presents a listing of the off-site population data. The tributary area boundaries are shown in Exhibit 2-12.

For the 6 MSF development the 11.8 MGD is composed of approximately 5.4 from the Project area while the off-site contribution remains constant at 6.4 MGD.

The estimate for sanitary flows were based on the assumption that 100 percent of the projected water demands is representative of the sanitary flows. This assumes that no water is actually consumed in an overall balance of the liquid flows.

1985 Park Plaza Storm Runoff Demands

The demand for combined sewer capacity due to storm water runoff for the two alternatives remains at the 1975 level of 150 cfs for a once in 15 year frequency storm. The 150 cfs represents a total of approximately 55 acres and includes the tributary area shown in Exhibit 2-12.

The storm water runoff quantity remains constant since no change in the values used in Equation 1 are anticipated due to any form of development.

TABLE 3-II

1985 Average Daily Demands For Park Plaza

		Alternative			
		"No Build"		6 Million Sq. Ft.	
Functional User	Use Per Capita Per Day, gpcd	Population	Demand, GPD	Population	Demand, GPD
Residential:					
Apartments	165	512	84,480	2,468	407,220
Employment:					
Retail, Office Hotel & School	55	5,193	285,615	10,406	572,330
Transients:					
Shoppers & Business	35	2,000	70,000	11,529	403,515
Hotel Guests	165	1,000	165,000	2,573	424,545
Total Population		8,705		26,976	
Average Daily Use, gpm			420		1,255
Average, gpcd:			70		67
Approximate Peak Use, gpm:			1,260		3,765

TABLE 3-IV

1985 Tributary Area Populations

Functional User	Population	Daily Demand MGD
Residential:		
Apartments	5,995	0.989
Employment:		
Retail, Office, Hotel & Schools	17,055	0.938
Transients:		
Shoppers & Business	1,200	0.042
Hotel Guests	1,000	0.165
Total Population	25,250	
Average Daily Demand, MGD:		2.134
Peak Daily Demand, MGD:		6.4

Table 3-III

Sanitary Sewer Capacities, Demand, Distribution

1985

Source Location	Peak Demand MGD by alt		Sewer Systems	Distribution by Alternative		
	Alt	Demand	Capacity without Surcharge	Alt	Normal Load	Adjusted Load
Project Area	6	5.4	St James (2.25 MGD)	6	3.6	2.25 a
	5	4.5		5	3.0	2.25 a
	4	3.6		4	2.4	2.25 a
	3	2.7		3	1.8	1.8
	2	1.8		2	1.2	1.2
Tributary Area		6.4	Combined sewer (9.0 MGD) under Garden	6	8.2	+1.35 = 9.55 b
				5	7.9	+0.75 = 8.65
				4	7.6	+0.15 = 7.75
				3	7.3	7.3
				2	7.0	7.0
Total Peak Demand	6	11.8	Total Capacity (11.2 MGD)			
	5	10.9				
	4	10.0				
	3	9.1				
	2	8.2				

a. for alts 4,5,6, diversion from St. James sewer is required

b. demand exceeds capacity causing a minor surcharge condition, considered acceptable by the public utility consultant.

DEVELOPMENT PROGRAM INTERPRETATION

ENERGY

The purpose of this section of the report is to determine the approximate peak loads and yearly consumption for electricity and/or steam and/or oil for the five alternative development programs.

Because there are no definitive building plans upon which to base heat loss, heat gain, and specific energy requirements for the building, estimated requirements have been based on assumptions and calculations, stated below, which are derived from historical data developed for other building types of similar nature.

In all cases, normative "norm" and energy conserving "low" loads and consumption were estimated. The "norm" is based on high quality construction which is currently used when intensive energy conservation designs are not a major design input. The "low" peak and consumption scenarios are based on assumptions of energy conservation features which have been developed for the New Hampshire, GSA Energy Conservation Demonstration building and can readily be accomplished in Boston with commercially available hardware.

Energy demand and consumption estimates for the normative "norm" construction are based on building materials, standards, and mechanical and electrical systems which a builder would use for luxury type buildings, if the user demanded facilities which would not require inordinately excessive fuel and electricity operating costs. The building would be insulated and the mechanical and electrical systems would be of high quality (window conditioners and through-the-wall air conditioning would not be used). Construction and equipment standards would not comply with new ASHRAE 90 P. standards which are being offered later this year, nor with state energy conservation standards for construction which are imminent.

The trend toward energy conservation construction standards is rapidly advancing in a number of states. California is the first to adopt energy budgets, which will limit the amount of energy to be used in each building to a specified number of BTU's per square foot per year. Appropriately, therefore, "low" energy demand and consumption calculations have been generated. They are based on buildings and systems standards which are at least as rigid as the proposed ASHRAE 90 P. standards; and in some cases are even more energy conservation-oriented where it is felt the 90 P. standards do not go far enough. The "low" numbers in the report indicate the potential which may

readily be accomplished by better insulation, better glazing (double windows), heat recovery from exhaust air to preheat the ventilation air, high quality central air conditioning equipment which varies the chilled water temperatures in accordance with thermal demands rather than at a fixed "low" temperature, variable air volume systems in the commercial structures rather than terminal re-heat or fixed volume air systems, etc. The "low" values are not, however, the ultimate that could be realized.

Total energy scenarios were based upon either engines or turbines using dual fuel - gas or oil for the seasonal efficiency of .70. In all cases, diversity due to the size of the project was estimated and was included in the analysis. Since Park Plaza is a luxury development, no window air conditioning units or through-the-wall units were included in the energy estimates. All systems were high-quality central systems.

SIX MILLION SQUARE FOOT ALTERNATIVE

RETAIL
NEW 352,000 SQUARE FEET
100% OF PLAN 6

		Maximum Peak	Minimum Peak	Maximum Yearly Consumption	Minimum Yearly Consumption
A.	Lighting 70 hrs/week	1,410 kw	880 kw	5,132,000 kwh	3,203,000 kwh
B.	Motors	530 kw	350 kw	2,120,000 kwh	1,400,000 kwh
C.	Air Conditioning	1,470 kw	900 kw	1,764,000 kwh	1,080,000 kwh
D.	Alt Elect Res Htg	2,460 kw	1,580 kw	2,062,700 kwh	1,320,000 kwh
E.	Alt Heat Pump, Htg	1,230 kw	585 kw	1,031,300 kwh	754,400 kwh
F.	Steam Htg	10,500 lbs/hr	7,000 lbs/hr	7,000,000 lbs	5,000,000 lbs
G.	Steam Dom HW	1,280 lbs/hr	960 lbs/hr	1,100,000 lbs	788,000 lbs
H.	ABS* Cool Steam	26,460 lbs/hr	16,200 lbs/hr	31,750,000 lbs	19,440,000 lbs
I.	Turb ABS* Cool Steam	17,640 lbs/hr	10,800 lbs/hr	21,145,500 lbs	12,947,000 lbs
J.	Oil Htg & HW Gallons	105 g/hr	70 g/hr	70,000 gals	50,000 gals
K.	Tons of Air Cond	1,470 tons	900 tons	1,764,000 tons	1,080,000 tons

*Absorption

SIX MILLION SQUARE FOOT ALTERNATIVE

OFFICE
NEW 1,823,500 SQUARE FEET
100% OF PLAN 6

		Maximum Peak	Minimum Peak	Maximum Yearly Consumption	Minimum Yearly Consumption
A.	Lighting	6,380 kw	3,650 kw	15,950,000 kwh	9,125,000 kwh
B.	Motors	4,000 kw	2,200 kw	12,000,000 kwh	6,600,000 kwh
C.	Air Conditioning	7,300 kw	4,560 kw	7,300,000 kwh	4,560,000 kwh
D.	Alt Elect Res Htg	12,760 kw	8,200 kw	13,036,000 kwh	8,325,000 kwh
E.	Alt Heat Pump Htg	4,910 kw	2,730 kw	5,014,000 kwh	2,775,000 kwh
F.	Steam Htg	66,360 lbs/hr	44,240 lbs/hr	44,240,000 lbs	31,650,000 lbs
G.	Steam Dom HW	6,600 lbs/hr	4,400 lbs/hr	7,000,000 lbs	5,064,000 lbs
H.	ABS Cooling	132,000 lbs/hr	82,000 lbs/hr	132,000,000 lbs	82,000,000 lbs
I.	Turbine ABS Cool	86,700 lbs/hr	54,000 lbs/hr	86,700,000 lbs	54,000,000 lbs
J.	Oil Htg	660 g/hr	440 g/hr	440,000 gals	316,000 gals
K.	Tons of Air Cond	7,300 tons	4,560 tons		

SIX MILLION SQUARE FOOT ALTERNATIVE

RESIDENTIAL
1,945,000 SQUARE FEET
100% OF PLAN 6

		Maximum Peak	Minimum Peak	Maximum Yearly Consumption	Minimum Yearly Consumption
A.	Light and Appl Elec	5,520 kw	4,400 kw	15,130,000 kwh	12,100,000 kwh
B.	Air Conditioning	4,280 kw	3,100 kw	352,400 kwh	248,000 kwh
C.	Heat, Steam	70,800 lbs/hr	47,000 lbs/hr	52,500,000 lbs	37,500,000 lbs
D.	Domestic HW Steam	15,000 lbs/hr	9,400 lbs/hr	17,500,000 lbs	12,500,000 lbs
E.	Heat Oil	710 g/hr	470 g/hr	525,000 gals	375,000 gals
F.	Dom HW Oil	150 g/hr	90 g/hr	175,000 gals	125,000 gals
G.	Cooling ABS	77,000 lbs/hr	55,800 lbs/hr	6,160,000 lbs	4,464,000 lbs
H.	Cooling Turbine ABS	50,800 lbs/hr	36,800 lbs/hr	4,064,000 lbs	2,944,000 lbs
I.	Light App (less Cook)	4,600 kw	3,600 kw	13,200,000 kwh	10,000,000 kwh
J.	Gas - Cooking Gas	33,060 lbs/hr	23,150 lbs/hr	8,225,000 lbs	6,000,000 lbs
K.	Res Elec Htg	20,000 kw	14,000 kw	15,000,000 kwh	10,000,000 kwh
L.	Heat Pump	17,000 kw	12,000 kw	7,000,000 kwh	4,000,000 kwh
M.	Tons Cooling	4,280	3,100	342,000	248,000

SIX MILLION SQUARE FOOT ALTERNATIVE

HOTEL
377,000 SQUARE FEET

		Maximum Peak	Minimum Peak	Maximum Yearly Consumption	Minimum Yearly Consumption
A.	Lights and Motors	2,400 kw	1,920 kw	9,000,000 kwh	7,200,000 kwh
B.	Elec Air Cond	1,390 kw	700 kw	1,668,000 kwh	960,000 kwh
C.	Steam Heating	15,000 lbs/hr	10,500 lbs/hr	20,000,000 lbs	15,000,000 lbs
D.	Steam Dom HW	7,000 lbs/hr	5,000 lbs/hr	10,000,000 lbs	8,000,000 lbs
E.	Elec Htg Resist	3,300 kw	2,000 kw	6,000,000 kwh	4,000,000 kw
F.	Elec Htg Heat Pump	2,200 kw	1,200 kw	3,000,000 kwh	1,500,000 kw
G.	Oil Space Htg	150 g/hr	105 g/hr	2,000,000 gals	1,500,000 gals
H.	Oil Dom HW	70 g/hr	50 g/hr	1,000,000 gals	800,000 gals
I.	ABS Cool	25,000 lbs/hr	12,600 lbs/hr	30,000,000 lbs	15,000,000 lbs
J.	Turbine ABS Cool	16,680 lbs/hr	8,400 lbs/hr	20,000,000 lbs	10,000,000 lbs
K.	Tons Air Cond	1,390	700	1,668,000	960,000

Inquiries of Boston Edison Utility Company disclose that steam condensate in the building is wasted to drain, rather than returned to the steam plant. This, of course, increases the water rate to produce steam (more BTU's per pound of steam are required and more gallons of oil burned per pound of steam generated). Additional savings over the "low" values, in energy, and a subsequent reduction in the pounds of steam consumed within the building can be realized by utilizing the hot condensate to heat domestic hot water and/or temper ventilation air in the winter; for space heating, or even to operate absorption refrigeration equipment. The rise of condensate in these manners can reduce the annual steam requirements to an even greater extent than indicated by the "low" consumption figures.

There are many other energy conservation measures which were not considered, since this is not a "design" project, such as storage of heat or chilled water for use during peak capacity periods, load levelling which will reduce electrical and steam, and other equally effective energy conservation measures and energy load management practices.

Originally, 20 scenarios were selected for analyses, but after preparing basic demand and consumption requirements,

the number was reduced to seven. "Norm" and "low" figures were calculated for each of the seven scenarios. Each scenario assumes private utility supply of electricity for motors, lighting, cooking, and appliances. Scenario variances occur in air-conditioning and heating systems.

Scenario I	AC	Central electric centrifugal chiller for each building.
	HTG	Central district steam heating
Scenario II	AC	Central electric centrifugal chiller for each building
	HTG	Heat pumps
Scenario III	AC	Central electric centrifugal chiller for each building
	HTG	Oil heating plant for each building
Scenario IV	AC	Central district steam absorption air conditioning for each building
	HTG	Central district steam heating
Scenario V	AC	Oil-fired absorption air conditioning for each building
	HTG	Oil heating plant for each building

Scenario VI	AC	Central steam turbine-absorption air conditioning for entire development
	HTG	Central district steam heating
Scenario VII	AC	Central oil-fired absorption air conditioning for entire development
	HTG	Central oil heating plant for entire development

Thirteen scenarios were given cursory evaluation but excluded from this report because they were not sufficiently dissimilar from those included.

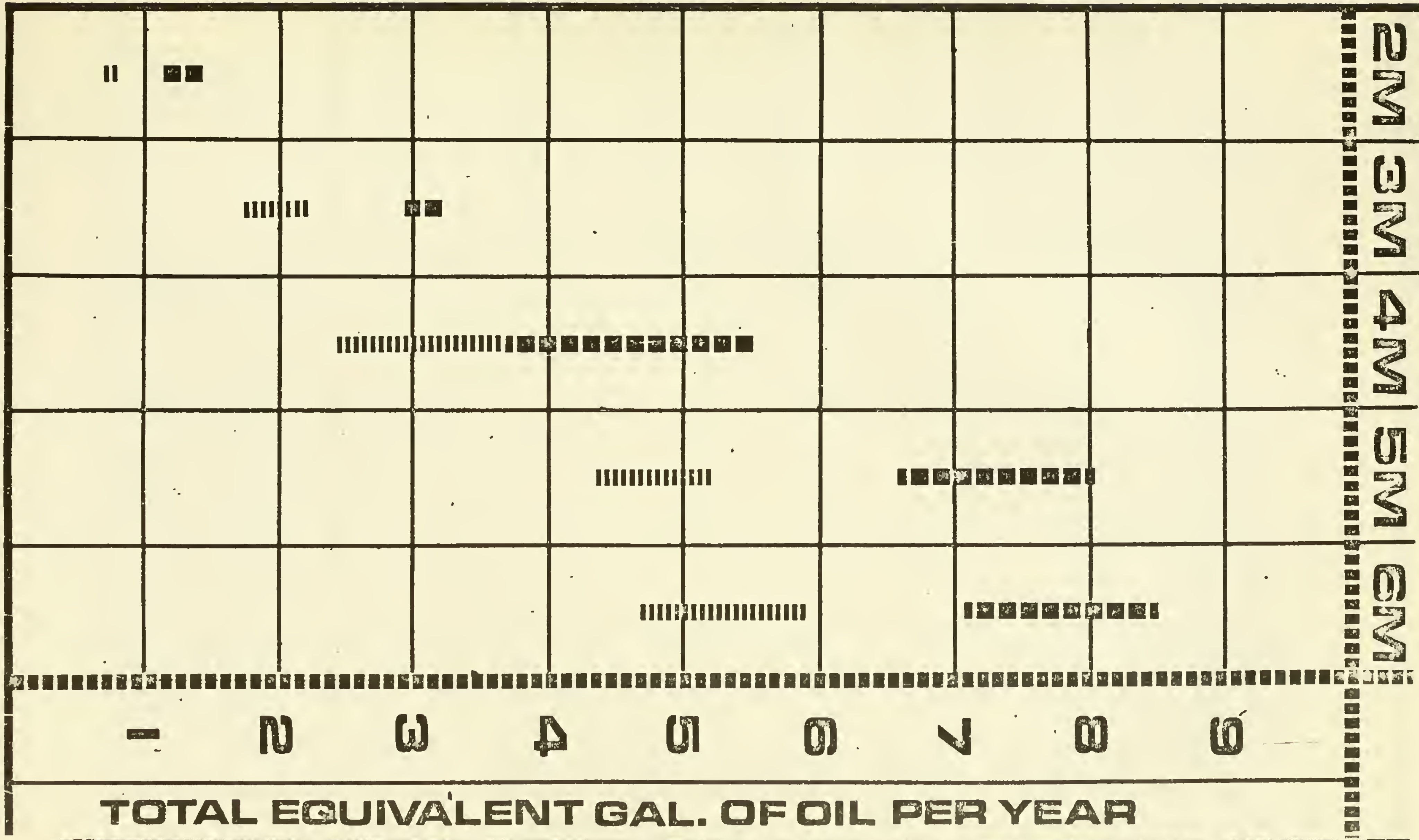
The use of direct electric resistance heating is possible in the buildings, providing the utility company can provide sufficient power, but it is not considered herein because of the large drain on raw sources energy needed to produce electricity. If oil or gas are in short supply, but electricity is available either through coal or nuclear facilities, the electric heat pump for heating (Scenario II), which would use anywhere from 1/3 to 1/5 of the power required for electrical resistance heating, would be a viable alternative to direct steam.

The energy study prepared in 1972 for this project has been examined. At the time that the study was done, certain

assumptions were made. Since 1972, there have been new developments, new equipment and new standards which will result in lower energy demand and consumption; these new developments have been taken into account.

Peak electrical and steam demands may occur either in the summer or winter. For example, Scenario I, which includes all electric motors, lights and appliances, electric refrigeration, and steam for space heating and domestic hot water, the peak electrical consumption demand will occur in the summer, and the peak steam demand will occur in the winter. If absorption or turbine absorption refrigeration were used instead of electric air conditioning, the peak electrical demand would be in the winter and the peak steam demand in the summer.

In order to fully determine the impact on resources in the Boston area, electric and steam requirements at the building boundary line have been converted to raw source energy requirements using 10,800 BTU's per KW generated as the water rate for electric power generation and 1,700 BTU's of fuel for each pound of steam generated as per Boston Edison's information dated June 2, 1975. To each of these water rates (fuel rates), distribution losses of 10% for the steam system and 5% for the electrical power distribution system have been added. A seasonal efficiency of 67% has been used for all on-site oil burning plants.



PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

PREPARED BY:
BOSTON REDEVELOPMENT AUTHORITY
CITY HALL
BOSTON, MASSACHUSETTS

THE SARATOGA ASSOCIATES
BRISTOL, LITYNSKI, WOJCIK, TARBOX, HOLLISTER, CINQUINO, AND MOORE PC
THE ARCADE
SARATOGA SPRINGS, NEW YORK

TOTAL EQUIVALENT OIL
COMPARISON CHART

"NORM" ▮▮▮▮▮▮▮▮▮
"LOW" ||||||||||||||||||||

TOTALS with all electric motors, lighting, cooking and appliances.	AC - ELEC. CHILLER BLDG HTG - CENTRAL STEAM	AC - ELEC. CHILLER BLDG HTG - ELEC. HEAT PUMP	AC - ELEC. CH. .LER BLDG. HTG - OIL PLANT BLDG.	AC - STEAM ABSORP BLDG HTG - CENTRAL STEAM	AC - OIL ABSORP. BLDG HTG - OIL PLANT BLDG	AC - STEAM ABSORP. PROJECT HTG - CENTRAL STEAM	AC - OIL ABSORP. PROJECT HTG - OIL PLANT PROJECT
ELECTRIC PEAK (KW)	35,825	54,070	35,825	21,384	21,384	21,384	21,384
ELECTRIC YRLY. CONS (KWH/YR)	72,218,200	98,650,350	72,218,200	62,133,800	62,133,800	62,133,800	62,133,800
STEAM PEAK (LBS/HR)	192,540	--	--	290,340	--	130,360	--
STEAM YRLY CONS (LBS/YR)	159,340,000	--	--	359,250,000	--	291,825,500	--
OIL YRLY CONS (GAL/YR)	--	--	1,600,000	--	3,592,000	--	2,918,000
ELECTRIC EQUIV. OIL (GAL/YR)	5,460,000	7,458,000	5,460,000	4,697,000	4,697,000	4,697,000	4,697,000
STEAM EQUIV OIL (GAL/YR)	1,689,000	--	--	3,808,000	--	2,918,000	--
TOTAL EQUIV OIL (GAL/YR)	7,149,000	7,458,000	7,060,000	8,505,000	8,289,000	7,615,000	7,615,000
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

BOSTON REDEVELOPMENT AUTHORITY
CITY HALL
BOSTON, MASSACHUSETTS

THE SARATOGA ASSOCIATES
SARATOGA SPRINGS, NEW YORK
DATE:

TOTALS with all electric motors, lighting, cooking and appliances.	AC - ELEC. CHILLER BLDG HTG - CENTRAL STEAM	AC - ELEC. CHILLER BLDG HTG - ELEC. HEAT PUMP	AC - ELEC. CHILLER BLDG HTG. - OIL PLANT BLDG.	AC-STEAM ABSORP BLDG HTG. - CENTRAL STEAM	AC - OIL ABSORP. BLDG HTG - OIL PLANT BLDG.	AC-STEAM ABSORP. PROJECT HTG. - CENTRAL STEAM	AC - OIL ABSORP. PROJECT HTG - OIL PLANT PROJECT
ELECTRIC PEAK (KW)	33,568	45,908	33,568	19,998	19,998	19,998	19,998
ELECTRIC YRLY CONS (KWH/YR)	69,002,600	91,926,915	69,002,600	57,484,000	57,484,000	57,484,000	57,484,000
STEAM PEAK (LBS /HR)	169,490	--	--	270,125	--	186,765	--
STEAM YRLY. CONS (LBS / YR)	139,854,000	--	--	347,695,000	--	277,317,000	--
OIL YRLY CONS (GAL / YR)	--	--	1,400,000	--	3,477,000	--	2,773,000
ELECTRIC EQUIV OIL (GAL / YR)	5,217,000	6,950,000	5,217,000	4,346,000	4,346,000	4,346,000	4,346,000
STEAM EQUIV OIL (GAL / YR)	1,482,000	--	--	3,686,000	--	2,940,000	--
TOTAL EQUIV OIL (GAL / YR)	6,699,000	6,950,000	6,617,000	8,032,000	7,823,000	7,286,000	7,119,000
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
REDEVELOPMENT AUTHORITY
ASSOCIATES

TOTALS with all electric motors, lighting, cooking and appliances.	AC - ELEC. CHILLER BLDG HTG - CENTRAL STEAM	AC - ELEC. CHILLER BLDG HTG-ELEC. HEAT PUMP	AC-ELEC. CHILLER BLDG. HTG - OIL PLANT BLDG.	AC-STEAM ABSORP. BLDG HTG. - CENTRAL STEAM	AC-OIL ABSORP BLDG HTG - OIL PLANT BLDG	AC-STEAM ABSORP. PROJECT HTG. - CENTRAL STEAM	AC-OIL ABSORP PROJECT HTG - OIL PLANT PROJECT
ELECTRIC PEAK (KW)	23,335	34,755	23,335	13,935	13,935	13,935	13,953
ELECTRIC YRLY. CONS (KWH/YR)	48,535,500	49,511,357	48,535,500	41,006,000	41,006,000	41,006,000	41,006,000
STEAM PEAK (LBS/HR)	125,740	--	--	190,280	--	132,760	--
STEAM YRLY. CONS (LBS/YR)	108,576,000	--	--	244,332,000	--	197,913,800	--
OIL YRLY CONS (GAL/YR)	--	--	1,095,000	--	2,443,320	--	1,979,140
ELECTRIC EQUIV. OIL (GAL/YR)	3,669,000	3,743,000	3,669,000	3,100,000	3,100,000	3,100,000	3,100,000
STEAM EQUIV OIL (GAL/YR)	1,151,000	--	--	2,590,000	--	2,098,000	--
TOTAL EQUIV OIL (GAL/YR)	4,820,000	3,743,000	4,754,000	5,690,000	5,543,320	5,198,000	5,079,140
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

BOSTON REDEVELOPMENT AUTHORITY
BOSTON, MASSACHUSETTS

THE SARATOGA ASSOCIATES
SARATOGA SPRINGS, NEW YORK

TOTALS with all electric motors, lighting, cooking and appliances.	AC-ELEC. CHILLER BLDG HTG.-CENTRAL STEAM	AC-ELEC. CHILLER BLDG HTG-ELEC. HEAT PUMP	AC-ELEC. CHILLER BLDG HTG.-OIL PLANT BLDG.	AC-STEAM ABSORP. BLDG HTG-CENTRAL STEAM	AC-OIL ABSORP BLDG HTG-OIL PLANT BLDG.	AC-STEAM ABSORP. PROJECT HTG.-CENTRAL STEAM	AC-OIL ABSORP PROJECT HTG-OIL PLANT PROJECT
ELECTRIC PEAK (KW	15,232	23,853	15,232	9,080	9,080	9,080	9,080
ELECTRIC YRLY. CONS. (KWH/YR)	31,180,000	33,016,215	31,180,000	26,373,000	26,373,000	26,373,000	26,373,000
STEAM PEAK (LBS/HR)	85,598	--	--	122,698	--	86,998	--
STEAM YRLY CONS (LBS./YR)	75,733,000	--	--	104,057,000	--	91,620,000	--
OIL YRLY CONS (GAL/YR)	--	--	750,000	--	1,040,570	--	916,200
ELECTRIC EQUIV OIL (GAL/YR)	2,357,000	3,200,000	2,357,000	1,994,000	1,994,000	1,994,000	1,994,000
STEAM EQUIV OIL (GAL./YR)	803,000	--	--	1,103,000	--	971,000	--
TOTAL EQUIV OIL (GAL./YR)	3,160,000	3,200,000	3,107,000	3,097,000	3,034,570	2,965,000	2,910,200
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

BOSTON RE[illegible]OPMENT AUTHORITY
CITY HALL

THE SARATC [illegible] ASSOCIATES

BOSTON, MASSACHUSETTS

TOTALS with all electric motors, lighting, cooking and appliances.	AC-ELEC. CHILLER BLDG HTG.-CENTRAL STEAM	AC-ELEC. CHILLER BLDG HTG-ELEC. HEAT PUMP	AC-ELEC CHILLER BLDG HTG.-OIL PLANT BLDG	AC-STEAM ABSORP BLDG HTG.-CENTRAL STEAM	AC-OIL ABSORP. BLDG HTG.-OIL PLANT BLDG	AC-STEAM ABSORP PROJECT HTG.-CENTRAL STEAM	AC-OIL ABSORP. PROJECT HTG.-OIL PLANT PROJECT
ELECTRIC PEAK (KW	6,499	9,671	6,499	3,977	3,977	3,977	3,977
ELECTRIC YRLY CONS (KWH/YR)	12,237,500	17,842,120	12,237,500	10,460,000	10,460,000	10,460,000	10,460,000
STEAM PEAK (LBS./HR)	33,429	--	--	49,999	--	34,669	--
STEAM YRLY CONS (LBS/YR)	25,384,000	--	--	37,131,000	--	33,482,000	--
OIL YRLY CONS. (GAL/YR)	--	--	254,000	--	371,310	--	334,820
ELECTRIC EQUIV. OIL (GAL/YR)	925,000	1,400,000	925,000	791,000	791,000	791,000	791,000
STEAM EQUIV. OIL (GAL./YR)	269,000	--	--	394,000	--	354,000	--
TOTAL EQUIV OIL (GAL/YR)	1,194,000	1,400,000	1,179,000	1,185,000	1,162,000	1,145,000	1,125,820
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
THE SARATOGA ASSOCIATES

TOTALS with all electric motors, lighting, cooking and appliances.	AC - ELEC. CHILLER BLDG HTG. - CENTRAL STEAM	AC - ELEC. CHILLER BLDG HTG-ELEC. HEAT PUMP	AC-ELEC. CHILLER BLDG HTG. - OIL PLANT BLDG.	AC-STEAM ABSORP BLDG HTG - CENTRAL STEAM	AC - OIL ABSORP. BLDG HTG - OIL PLANT BLDG.	AC-STEAM ABSORP. PROJECT HTG. - CENTRAL STEAM	AC - OIL ABSORP PROJECT HTG - OIL PLANT PROJECT
ELECTRIC PEAK (KW)	23,240	35,280	23,240	13,980	13,980	13,980	13,980
ELECTRIC YRLY. CONS (KWH/YR)	47,385,000	63,155,588	47,385,000	40,537,000	40,537,000	40,537,000	40,537,000
STEAM PEAK (LBS/HR)	128,500	--	--	186,360	--	88,100	--
STEAM YRLY. CONS (LBS/YR)	115,502,000	--	--	269,000,000	--	195,393,000	--
OIL YRLY CONS (GAL/YR)	--	--	1,150,000	--	2,690,000	--	1,954,000
ELECTRIC EQUIV. OIL (GAL/YR)	3,582,000	4,774,500	3,582,000	3,065,000	3,065,000	3,065,000	3,065,000
STEAM EQUIV OIL (GAL/YR)	1,224,000	--	--	2,851,000	--	1,954,000	--
TOTAL EQUIV OIL (GAL./YR)	4,806,000	4,774,500	4,732,000	5,916,000	5,755,000	5,019,000	5,019,000
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
THE SARATOGA ASSOCIATES

TOTALS with all electric motors, lighting, cooking and appliances.	AC - ELEC. CHILLER BLDG HTG - CENTRAL STEAM	AC - ELEC CHILLER BLDG HTG - ELEC HEAT PUMP	AC - ELEC CHILLER BLDG HTG - OIL PLANT BLDG	AC - STEAM ABSORP BLDG HTG - CENTRAL STEAM	AC - OIL ABSORP BLDG HTG - OIL PLANT BLDG	AC - STEAM ABSORP PROJECT HTG - CENTRAL STEAM	AC - OIL ABSORP PROJECT HTG - OIL PLANT PROJECT
ELECTRIC PEAK (KW)	21,279	29,259	21,279	12,719	12,719	12,719	12,719
ELECTRIC YRLY CONS (KWH/YR)	44,353,500	57,971,630	44,353,500	37,241,500	37,241,500	37,241,500	37,241,500
STEAM PEAK (LBS/HR)	113,385	--	--	171,095	--	118,735	--
STEAM YRLY CONS (LBS/YR)	101,594,200	--	--	227,236,200	--	184,589,200	--
OIL YRLY CONS (GAL/YR)	--	--	1,016,000	--	2,272,360	--	1,845,890
ELECTRIC EQUIV OIL (GAL/YR)	3,353,000	4,383,000	3,353,000	2,815,000	2,815,000	2,815,000	2,815,000
STEAM EQUIV OIL (GAL/YR)	1,077,000	--	--	2,409,000	--	1,957,000	--
TOTAL EQUIV OIL (GAL/YR)	4,430,000	4,383,000	4,369,000	5,224,000	5,087,360	4,772,000	4,660,890
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
THE SARATOGA ASSOCIATES

TOTALS with all electric motors, lighting, cooking and appliances.	AC-ELEC. CHILLER BLDG HTG.-CENTRAL STEAM	AC-ELEC. CHILLER BLDG HTG-ELEC HEAT PUMP	AC-ELEC CHILLER BLDG HTG.-OIL PLANT BLDG	AC-STEAM ABSORP BLDG HTG-CENTRAL STEAM	AC-OIL ABSORP BLDG HTG-OIL PLANT BLDG	AC-STEAM ABSORP PROJECT HTG-CENTRAL STEAM	AC-OIL ABSORP PROJECT HTG-OIL PLANT PROJECT
ELECTRIC PEAK (KW)	15,202	22,990	15,202	9,252	9,252	9,252	9,252
ELECTRIC YRLY CONS (KWH/YR)	32,304,600	32,806,225	32,304,600	27,682,000	27,682,000	27,682,000	27,682,000
STEAM PEAK (LBS/HR)	84,210	--	--	120,970	--	84,550	--
STEAM YRLY CONS (LBS/YR)	79,195,000	--	--	160,070,000	--	132,683,000	--
OIL YRLY CONS (GAL/YR)	--	--	792,000	--	1,600,700	--	1,326,800
ELECTRIC EQUIV OIL (GAL/YR)	2,442,000	2,480,000	2,442,000	2,093,000	2,093,000	2,093,000	2,093,000
STEAM EQUIV OIL (GAL/YR)	839,000	--	--	1,697,000	--	1,406,000	--
TOTAL EQUIV OIL (GAL/YR)	3,281,000	2,480,000	3,234,[illegible]	3,790,000	3,693,700	3,499,000	3,419,800
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

PREPARED BY
BOSTON REDEVELOPMENT AUTHORITY
CITY HALL BOSTON, MASSACHUSETTS
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THE ARCADE SARATOGA SPRINGS, NEW YORK
DATE

LOW

TOTALS with all electric motors, lighting, cooking and appliances.	ELECTRIC PEAK (KW)	ELECTRIC YRLY. CONS (KWH/YR)	STEAM PEAK (LBS/HR)	STEAM YRLY CONS (LBS/YR)	OIL YRLY CONS (GAL/YR)	ELECTRIC EQUIV OIL (GAL/YR)	STEAM EQUIV OIL (GAL/YR)	TOTAL EQUIV OIL (GAL/YR)	
AC-ELEC. CHILLER BLDG HTG.-CENTRAL STEAM	9,955	20,970,000	56,826	54,987,000	--	1,585,000	583,000	2,168,000	1
AC-ELEC. CHILLER BLDG. HTG-ELEC. HEAT PUMP	15,496	28,119,839	--	--	--	2,200,000	--	[illegible]	2
AC-ELEC. CHILLER BLDG HTG-OIL PLANT BLDG.	9,955	20,970,000	--	--	550,000	1,535,000	--	[illegible]	3
AC-STEAM ABSORP BLDG HTG.-CENTRAL STEAM	6,045	18,142,000	78,546	63,890,000	--	1,372,000	677,000	2,049,000	4
AC-OIL ABSORP BLDG HTG-OIL PLANT BLDG.	6,045	18,142,000	--	--	638,900	1,372,000	--	2,011,000	5
AC-STEAM ABSORP. PROJECT HTG.-CENTRAL STEAM	6,045	18,142,000	55,906	46,910,000	--	1,372,000	497,000	1,669,000	6
AC-OIL ABSORP PROJECT HTG-OIL PLANT PROJECT	6,045	18,142,000	--	--	469,100	1,372,000	--	1,841,000	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
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TOTALS with all electric motors, lighting, cooking and appliances.	AC-ELEC. CHILLER BLDG HTG.- CENTRAL STEAM	AC-ELEC CHILLER BLDG HTG-ELEC HEAT PUMP	AC-ELEC CHILLER BLDG HTG -OIL PLAN - BLDG	AC-STEAM ABSORP BLDG HTG -CENTRAL STEAM	AC-OIL ABSORP BLDG HTG -OIL PLANT BLDG	AC-STEAM ABSORP PROJECT HTG -CENTRAL STEAM	AC-OIL ABSORP PROJECT HTG -OIL PLANT PROJECT
ELECTRIC PEAK (KW)	4,147	6,267	4,147	2,489	2,489	2,489	2,489
ELECTRIC YRLY CONS (KWH/YR)	7,739,600	10,124,791	7,739,600	6,627,000	6,627,000	6,627,000	6,627,000
STEAM PEAK (LBS /HR)	/ 22,124	--	--	32,764	--	22,564	--
STEAM YRLY CONS (LBS /YR)	18,153,000	--	--	23,638,000	--	16,825,000	--
OIL YRLY CONS. (GAL / YR)	--	--	181,000	--	236,380	--	168,250
ELECTRIC EQUIV. OIL (GAL /YR)	585,000	740,000	585,000	501,000	501,000	501,000	501,000
STEAM EQUIV OIL (GAL /YR)	192,000	--	--	251,000	--	178,000	--
TOTAL EQUIV OIL (GAL /YR)	777,000	740,000	766,000	752,000	737,380	679,000	669,000
	1	2	3	4	5	6	7

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS
BOSTON REDEVELOPMENT AUTHORITY
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THE SARATOGA ASSOCIATES
SARATOGA SPRINGS, NEW YORK

2M
LOW

DEMOGRAPHIC STRUCTURE

- Construction Labor Force
- Demographic Structure

OBJECTIVE:

This section of the report addresses the range of potential impacts of the five development program alternatives on the construction labor force of metropolitan Boston.

METHODOLOGY:

o DEMAND: For each development program alternative, two models were established: one reflecting a labor intensive design (cast in place concrete / masonry enclosure / etc.) and the other reflecting a design which was not labor intensive (steel frame / metal decks / metal and glass enclosure / etc.). From these models, craft profiles were calculated and superimposed on staging schedules to produce estimates of total annual demand for craft labor. Those calculations are displayed for each of seven major crafts and an eighth category which represents all the other crafts.

ASSUMPTIONS:

- UNION LABOR: The scale of even the smallest alternative program suggests that the work will be done by union workers, and the calculations assume that it will.

- LINEAR PROGRESS: This study accepts the approximation that the work will go forward in a more or less uniform way, and calculations of annual labor demand are made by dividing the estimated total demand by the estimated total construction time in years.

- ALL DEVELOPMENT IS NEW: This study interpreted the programs to mean all the work identified as "new development" was new construction, and that renovation of existing buildings was not included. Construction labor demand for such renovation work would have to be added to the estimated demand identified in this report.

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	%FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE	1.0	--	--	--	3.0	1.0	--	5.0	10.0	65	15
ENCLOSURE	0.7	--	--	--	--	0.3	0.8	0.2	2.0	65	3
PTNS/FINISH	1.0	--	--	--	--	0.5	--	2.5	4.0	65	6
STAIRS	--	--	--	--	0.1	0.1	--	0.3	0.5	50	1
ELEVATORS	0.3	--	--	--	--	--	--	--	0.3	33	1
SPCLTS/EQPT	0.3	--	--	--	--	0.2	--	1.0	1.5	50	3
PLUMBING	--	--	--	0.6	--	--	--	--	0.6	60	1
HVAC	--	--	2.0	--	--	--	--	--	2.0	40	5
ELECTRIC	--	2.0	--	--	--	--	--	--	2.0	50	4
SITEWORK	0.2	--	--	--	--	0.3	--	--	0.5	50	1
TOTAL COST	3.5	2.0	2.0	0.6	3.1	2.4	0.8	9.0	23.4	58.5	40
MAN-HOURS											
MH/MSF	233	133	133	40	207	200	53	600	--	--	--

PARK PLAZA BUILDING STUDY STAGE ENVIRONMENTAL IMPACT ANALYSIS

PREPARED BY:
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BRISTOL, LITYNSKI, WOJCIK, TARBOX, HOLLISTER, CINQUINO, AND MOORE P.C.
THE ARCADE SARATOGA SPRINGS, NEW YORK

RETAIL

HIGH LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	% FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE	1.1	--	--	--	3.3	1.1	--	5.5	11.0	65	17
ENCLOSURE	0.2	--	--	--	0.1	0.7	1.6	--	2.6	65	4
PTNS/FINISH	1.0	--	--	--	--	0.6	--	3.0	4.6	65	7
STAIRS	--	--	--	--	0.1	0.1	--	0.3	0.5	50	1
ELEVATORS	1.0	--	--	--	--	--	--	--	1.0	33	3
SPCLTS/EQPT	0.1	--	--	--	--	0.1	--	0.3	0.5	50	1
PLUMBING	--	--	--	1.2	--	--	--	--	1.2	60	2
HVAC	--	--	2.8	--	--	--	--	--	2.8	40	7
ELECTRIC	--	2.0	--	--	--	--	--	--	2.0	40	5
SITEWORK	0.2	--	--	--	--	0.3	--	--	0.5	50	1
TOTAL COST	3.6	2.0	2.8	1.2	3.5	2.9	1.6	9.1	26.7	55.6	48
MAN-HOURS											
MH/MSF	240	133	187	80	233	242	107	607	--	--	--

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

PREPARED BY:
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THE ARCADE
SARATOGA SPRINGS, NEW YORK

OFFICES

HIGH LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	%FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE	1.0	--	--	--	3.0	1.0	--	5.0	10.0	65	15
ENCLOSURE	0.2	--	--	--	0.1	0.7	1.6	--	2.6	65	4
PTNS/FINISH	0.3	--	--	--	--	0.6	--	2.4	3.3	65	5
STAIRS	--	--	--	--	0.1	0.1	--	0.3	0.5	50	1
ELEVATORS	0.6	--	--	--	--	--	--	--	0.6	33	2
SPCLTS/EQPT	--	--	--	--	--	--	--	0.3	0.3	50	1
PLUMBING	--	--	--	1.8	--	--	--	--	1.8	60	3
HVAC	--	--	1.2	--	--	--	--	--	1.2	60	2
ELECTRIC	--	0.7	--	--	--	--	--	--	0.7	70	1
SITEWORK	0.2	--	--	--	--	0.3	--	--	0.5	50	1
TOTAL COST	2.3	0.7	1.2	1.8	3.2	2.7	1.6	8.0	21.5	--	36
MAN-HOURS										—	
MH/MSF	153	47	80	120	213	225	107	533	--	--	--

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

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THE SARATOGA ASSOCIATES
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THE ARCADE
SARATOGA SPRINGS, NEW YORK

APARTMENTS

HIGH LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	%FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE	1.1	--	--	--	3.3	1.1	--	5.5	11.0	65	17.0
ENCLOSURE	0.2	--	--	--	0.1	0.7	1.6	--	2.6	65	4.0
PTNS/FINISH	0.8	--	--	--	--	1.0	--	3.4	5.2	65	8.0
STAIRS	--	--	--	--	0.1	0.1	--	0.3	0.5	50	1.0
ELEVATORS	1.0	--	--	--	--	--	--	--	1.0	33	3.0
SPCLTS/EQPT	--	--	--	--	--	0.3	--	1.2	1.5	50	3.0
PLUMBING	--	--	--	3.6	--	--	--	--	3.6	60	6.0
HVAC	--	--	2.8	--	--	--	--	--	2.8	40	7.0
ELECTRIC	--	2.4	--	--	--	--	--	--	2.4	40	6.0
SITEWORK	0.2	--	--	--	--	0.3	--	--	0.5	50	1.0
TOTAL COST	3.3	2.4	2.8	3.6	3.5	3.5	1.6	10.4	31.1	55.5	56.0
MAN-HOURS											
MH/MSF	220	160	187	240	233	292	107	693	--	--	--

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

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SARATOGA SPRINGS, NEW YORK

HOTEL

HIGH LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	%FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE											
ENCLOSURE											
PTNS/FINISH	1.0	--	--	--	3.0	1.0	--	5.0	10.0	65	15.0
STAIRS											
ELEVATORS	0.6	--	--	--	--	--	--	--	0.6	33	0.2
SPCLTS/EQPT	--	--	--	--	--	--	--	0.1	0.1	50	0.2
PLUMBING	--	--	--	0.2	--	--	--	--	0.2	60	0.4
HVAC	--	--	--	--	--	--	--	--	--	--	--
ELECTRIC	--	0.5	--	--	--	--	--	--	0.5	60	0.8
SITEWORK	0.2	--	--	--	--	--	--	0.3	0.5	50	1.0
TOTAL COST	1.8	0.5	--	0.2	3.0	1.0	--	5.4	11.9	67.6	17.6
MAN-HOURS											
MH/MSF	120	33	--	13	200	67	--	360	--	--	--

PARK PLAZA BUILDING STUDY STAGE
ENVIRONMENTAL IMPACT ANALYSIS

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CITY HALL BOSTON, MASSACHUSETTS
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BRISTOL, LITYNSKI, WOJCIK, TADDOX, HOLLISTER, CINQUINO, AND MOORE PC
THE ARCADE SARATOGA SPRINGS, NEW YORK

PARKING

HIGH LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	% FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE	0.6	--	--	--	3.5	0.6	--	2.0	6.7	45	15
ENCLOSURE	0.3	--	--	--	1.0	--	--	--	1.3	45	3
PTNS/FINISH	1.0	--	--	--	--	0.5	--	2.5	4.0	65	6
STAIRS	--	--	--	--	0.4	--	--	--	0.4	40	1
ELEVATORS	0.3	--	--	--	--	--	--	--	0.33	33	1
SPCLTS/EQPT	0.3	--	--	--	--	0.2	--	1.0	1.5	50	3
PLUMBING	--	--	--	0.6	--	--	--	--	0.6	60	1
HVAC	--	--	2.0	--	--	--	--	--	2.0	40	5
ELECTRIC	--	2.0	--	--	--	--	--	--	2.0	50	4
SITEWORK	0.2	--	--	--	--	0.3	--	--	0.5	50	1
TOTAL COST	2.7	2.0	2.0	0.6	4.9	1.6	--	5.5	19.3	48.5	40
MAN-HOURS											
MH/MSF	180	130	130	40	327	133	--	367	--	--	--

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RETAIL

LOW LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	%FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE	0.6	--	--	--	4.4	0.6	--	2.0	7.6	45	17
ENCLOSURE	0.3	--	--	--	0.7	--	--	--	1.0	25	4
PTNS/FINISH	1.6	--	--	--	--	0.5	--	2.5	4.6	65	7
STAIRS	--	--	--	--	0.4	--	--	--	0.4	40	1
ELEVATORS	1.0	--	--	--	--	--	--	--	1.0	33	3
SPCLTS/EQPT	0.1	--	--	--	--	0.1	--	0.3	0.5	50	1
PLUMBING	--	--	--	1.2	--	--	--	--	1.2	60	2
HVAC	--	--	2.8	--	--	--	--	--	2.8	40	7
ELECTRIC	--	2.0	--	--	--	--	--	--	2.0	40	5
SITEWORK	--	--	--	--	--	0.3	--	--	0.5	50	1
TOTAL COST	3.6	2.0	2.8	1.2	5.5	1.5	--	4.8	21.4	44.6	48
MAN-HOURS											
MH/MSF	240	133	187	80	367	125	--	320	--	--	--

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OFFICES

LOW LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	%FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE	0.6	--	--	--	3.6	0.6	--	2.0	6.8	45	15
ENCLOSURE	0.3	--	--	--	1.0	--	--	--	1.3	33	4
PTNS/FINISH	0.3	--	--	--	--	0.6	--	2.4	3.3	65	5
STAIRS	--	--	--	--	0.4	--	--	--	0.4	40	1
ELEVATORS	0.6	--	--	--	--	--	--	--	0.6	33	2
SPCLTS/EQPT	--	--	--	--	--	--	--	0.3	0.3	50	1
PLUMBING	--	--	--	1.8	--	--	--	--	1.8	60	3
HVAC	--	--	1.2	--	--	--	--	--	1.2	60	2
ELECTRIC	--	0.7	--	--	--	--	--	--	0.7	70	1
SITEWORK	0.2	--	--	--	--	0.3	--	--	0.5	50	1
TOTAL COST	2.0	0.7	1.2	1.8	5.0	1.5	--	4.7	16.9	48.3	35
MAN-HOURS											
MH/MSF	133	47	80	120	333	125	--	313	--	--	--

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APARTMENTS

LOW LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	%FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE											
ENCLOSURE											
PTNS/FINISH	0.6	--	--	--	3.5	0.6	--	2.0	6.7	45	15.0
STAIRS											
ELEVATORS	0.6	--	--	--	--	--	--	--	0.6	33	0.2
SPCLTS/EQPT	--	--	--	--	--	--	--	0.1	0.1	50	0.2
PLUMBING	--	--	--	0.2	--	--	--	--	0.2	60	0.4
HVAC	--	--	--	--	--	--	--	--	--	--	--
ELECTRIC	--	0.5	--	--	--	--	--	--	0.5	60	0.8
SITEWORK	0.2	--	--	--	--	--	--	0.3	0.5	50	1.0
TOTAL COST	1.4	0.5	--	0.2	3.5	0.6	--	2.4	8.6	48.9	17.6
MAN-HOURS											
MH/MSF	93	33	--	13	233	50	--	160	--	--	--

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PARKING

LOW LABOR OPTION

	ALL OTHERS	ELECTRICIANS	STMFITTERS SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS	$ FIELD LABOR	%FIELD LABOR	ESTIMATED CONST. COST $ PER S.F.
STRUCTURE	0.6	--	--	--	4.4	0.6	--	2.0	7.6	45	17.0
ENCLOSURE	0.3	--	--	--	0.7	--	--	--	1.0	25	4.0
PTNS/FINISH	0.8	--	--	--	--	1.0	--	3.4	5.2	65	8.0
STAIRS	--	--	--	--	0.1	0.1	--	0.3	0.5	50	1.0
ELEVATORS	1.0	--	--	--	--	--	--	--	1.0	33	3.0
SPCLTS/EQPT	--	--	--	--	--	0.3	--	1.2	1.5	50	3.0
PLUMBING	--	--	--	3.6	--	--	--	--	3.6	60	6.0
HVAC	--	--	2.8	--	--	--	--	--	2.8	40	7.0
ELECTRIC	--	2.4	--	--	--	--	--	--	2.4	40	6.0
SITEWORK	0.2	--	--	--	--	0.3	--	--	0.5	50	1.0
TOTAL COST	2.9	2.4	2.8	3.6	5.2	2.3	--	6.9	26.1	46.6	56.0
MAN-HOURS											
MH/MSF	193	160	187	240	347	192	--	460	--	--	--

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HOTEL

LOW LABOR OPTION

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	352,000	87.0	46.8	46.8	14.1	72.9	70.4	18.7	211.2
OFFICE	1,823,500	437.6	242.5	340.9	145.9	424.9	441.3	195.1	1106.9
APARTMENTS	1,945,000	297.6	91.4	155.6	233.4	414.3	437.6	208.1	1036.7
PARKING	1,144,000	137.3	37.8	--	14.9	228.8	76.7	--	411.8
HOTEL	581,000	127.8	92.9	108.6	139.4	135.4	169.7	62.2	402.6
TOTAL	5,845,500	1082.3	511.4	651.9	547.7	1276.3	1195.7	484.1	3169.2
ANNUAL MH BASED ON 9.0 YEARS		120.3	56.8	72.4	60.9	141.8	132.9	53.8	352.1
AVG. NO. MEN BASED ON 2,000 HRS./YR		60.1	28.4	36.2	30.4	70.9	66.4	26.9	176.0

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6 MILLION ALTERNATIVE
HIGH LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	321,000	74.8	42.7	42.7	12.8	66.4	64.2	17.0	192.6
OFFICE	1,915,500	459.7	254.8	358.2	153.2	446.3	463.6	204.9	1162.7
APARTMENTS	1,285,000	196.6	60.4	102.8	154.2	273.7	289.1	137.5	684.9
PARKING	782,000	93.8	25.8	--	10.2	156.4	52.4	--	281.5
HOTEL	581,000	127.8	92.9	108.7	139.4	135.4	169.7	62.2	402.6
TOTAL	4,884,500	952.7	476.6	612.4	469.8	1078.2	1039.0	421.6	2724.3
ANNUAL MH BASED ON 9.0 YEARS		105.9	52.9	68.0	52.2	119.8	115.4	46.8	302.7
AVG. NO. MEN BASED ON 2,000 HRS./YR		53.0	26.5	34.0	26.1	59.9	57.7	23.4	151.4

5 MILLION ALTERNATIVE
HIGH LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	252,000	58.7	33.5	33.5	10.1	52.2	50.4	13.4	151.2
OFFICE	1,092,000	262.1	145.2	204.2	87.4	254.4	264.2	116.8	662.8
APARTMENTS	1,175,000	179.8	55.2	94.0	141.0	250.3	264.4	125.7	626.3
PARK!NG	609,000	73.1	20.1	--	7.9	121.8	40.8	--	219.2
HOTEL	618,500	136.1	98.9	115.7	148.4	144.1	180.6	66.2	428.6
TOTAL	3,746.500	709.8	352.9	447.4	394.8	822.8	800.4	322.1	2088.1
ANNUAL MH BASED ON 6.5 YEARS		109.2	54.3	68.8	60.7	126.6	123.1	49.6	321.2
AVG. NO. MEN BASED ON 2,000 HRS./YR		54.6	27.1	34.4	30.4	63.3	61.6	24.8	160.6

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4 MILLION ALTERNATIVE
HIGH LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	199,050	46.4	26.5	26.5	7.9	41.2	39.8	10.6	119.4
OFFICE	550,635	132.2	73.2	102.9	44.1	128.3	133.3	58.9	334.2
APARTMENTS	895,000	136.9	42.1	71.6	107.4	190.6	201.4	95.8	477.0
PARKING	551,090	66.1	18.1	--	7.2	110.2	36.9	--	198.3
HOTEL	320,000	70.4	51.2	59.8	76.8	74.6	93.4	34.2	221.8
TOTAL	2,515,775	452.0	211.1	260.8	243.4	544.9	504.8	199.5	1350.7
ANNUAL MH BASED ON 6.5 YEARS		69.5	32.5	40.1	37.4	83.8	77.7	30.7	207.8
AVG. NO. MEN BASED ON 2,000 HRS./YR		34.8	16.2	20.0	18.7	41.9	38.8	15.3	103.9

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3 MILLION ALTERNATIVE
HIGH LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	47,000	11.0	6.3	6.3	1.9	9.7	9.4	2.5	28.2
OFFICE	351,500	84.4	46.7	65.7	28.1	81.9	85.1	37.6	213.4
APARTMENTS	407,500	62.4	19.2	32.6	48.9	86.8	91.7	43.6	217.2
PARKING									
HOTEL									
TOTAL	806,000	157.8	72.2	104.6	78.9	178.4	186.2	83.7	458.8
ANNUAL MH BASED ON 2.5 YEARS		63.1	28.9	41.8	31.5	71.4	74.5	33.5	183.5
AVG. NO. MEN BASED ON 2,000 HRS./YR		31.6	14.4	20.9	15.8	35.7	37.3	16.8	91.8

2 MILLION ALTERNATIVE
HIGH LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	352,000	63.4	45.8	45.8	14.1	115.1	46.8	--	129.2
OFFICE	1,823,500	437.6	242.5	341.0	145.9	669.2	227.9	--	583.5
APARTMENTS	1,945,000	258.7	91.4	155.6	233.4	647.7	243.1	--	608.8
PARKING	1,144,000	106.4	37.8	--	14.9	266.6	57.2	--	183.0
HOTEL	581,000	112.1	93.0	108.7	139.4	201.6	111.6	--	267.3
TOTAL	5,845,500	978.2	510.5	651.1	547.7	1900.2	686.6	--	1771.8
ANNUAL MH BASED ON 9.0 YEARS		108.7	56.7	72.4	60.9	211.1	76.3	--	196.9
AVG. NO. MEN BASED ON 2,000 HRS./YR		54.4	28.4	36.2	30.4	105.6	38.2	--	98.5

6 MILLION ALTERNATIVE
LOW LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	321,000	57.8	41.7	41.7	12.8	105.0	42.7	--	117.8
OFFICE	1,915,500	459.7	254.8	358.2	153.2	703.0	239.4	--	613.0
APARTMENTS	1,285,000	170.9	60.4	102.8	154.2	428.0	160.6	--	402.2
PARKING	782,000	72.7	25.8	--	10.2	182.2	39.1	--	125.1
HOTEL	581,000	112.1	93.0	108.7	139.4	201.6	111.6	--	267.3
TOTAL	4,884,000	873.2	475.7	611.4	469.8	1619.8	593.4	--	1525.4
ANNUAL MH BASED ON 9.0 YEARS		97.0	52.9	67.9	52.2	180.0	65.9	--	169.5
AVG. NO. MEN BASED ON 2,000 HRS./YR		48.5	26.5	34.0	26.1	90.0	33.0	--	84.8

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5 MILLION ALTERNATIVE
LOW LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	252,000	45.4	32.8	32.8	10.1	82.4	33.5	--	92.5
OFFICE	1,092,000	262.1	145.2	204.2	87.4	400.8	136.5	--	349.4
APARTMENTS	1,175,000	156.3	55.2	94.0	141.0	391.3	146.9	--	367.8
PARKING	609,000	56.6	20.1	--	7.9	141.9	30.5	--	97.4
HOTEL	618,500	119.4	99.0	115.7	148.4	214.6	118.8	--	284.5
TOTAL	3,746,500	639.8	352.3	446.7	394.8	1231.0	466.2	--	1191.6
ANNUAL MH BASED ON 6.5 YEARS		98.4	54.2	68.7	60.7	189.4	71.7	--	183.3
AVG. NO. MEN BASED ON 2,000 HRS./YR		49.2	27.1	34.4	30.4	94.7	35.9	--	91.6

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4 MILLION ALTERNATIVE
LOW LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	199,050	35.9	25.9	25.9	8.0	65.1	26.5	--	73.1
OFFICE	550,635	132.2	73.2	103.0	44.1	202.1	68.8	--	176.2
APARTMENTS	895,000	119.0	42.1	71.6	107.4	298.0	111.9	--	280.1
PARKING	551,090	51.3	18.2	--	7.2	128.4	27.6	--	88.2
HOTEL	320,000	61.8	51.2	59.8	76.8	111.0	61.4	--	147.2
TOTAL	2,515,775	400.2	210.6	260.3	243.5	804.6	296.2	--	764.8
ANNUAL MH BASED ON 6.5 YEARS		61.6	32.4	40.1	37.5	123.8	45.6	--	117.6
AVG. NO. MEN BASED ON 2,000 HRS./YR		30.8	16.2	20.0	18.7	61.9	22.8	--	58.3

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3 MILLION ALTERNATIVE
LOW LABOR OPTION

MAN HOURS
(IN THOUSANDS)

SPACE TYPE	GSF	ALL OTHERS	ELECTRICANS	STM FTRS / SMW	PLUMBERS	IRONWORKER	LABORERS	BRICKLAYERS	CARPENTERS
RETAIL	47,000	8.5	6.1	6.1	1.9	15.4	6.3	--	17.3
OFFICE	351,500	84.4	46.8	65.7	28.1	129.0	43.9	--	112.5
APARTMENTS	407,500	54.2	19.2	32.6	48.9	135.7	50.9	--	127.6
PARKING	--	--	--	--	--	--	--	--	--
HOTEL	--	--	--	--	--	--	--	--	--
TOTAL	806,000	147.1	72.1	104.4	78.9	280.1	101.1	--	257.4
ANNUAL MH BASED ON 2.5 YEARS		58.8	28.8	41.8	31.6	112.0	40.4	--	103.0
AVG. NO. MEN BASED ON 2,000 HRS./YR		29.4	14.4	20.9	15.8	56.0	20.2	--	51.5

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2 MILLION ALTERNATIVE
LOW LABOR OPTION

MAN HOURS
(IN THOUSANDS)

DEMOGRAPHIC STRUCTURE

The information contained in this section of the report was extracted from the Park Plaza User Population Report (B.R.A. - 1975) and is intended to accomplish the following:

- To identify the probable number of residents, employees, visitors and shoppers for each of the development alternatives.
- To indicate the probable origin of new residents, employees, and shoppers associated with each of the development alternatives.
- To describe the likely demographic and economic characteristics of the new user population.

I. Summary Tables

Total Future Park Plaza Population

Table 1a

Alternative	New Development	Retention	Total
2 Million			
Residents	494	30	526
Other*	1,472	1,295	3,767
Total	1,966	1,325	4,293
3 Million			
Residents	1,125	4	1,129
Other	11,507	702	12,209
Total	12,632	706	13,338
4 Million			
Residents	1,493	3	1,496
Other	16,440	584	17,024
Total	17,933	587	18,520
5 Million			
Residents	1,628	1	1,629
Other	23,609	42	23,651
Total	25,237	43	25,280
6 Million			
Residents	2,468	-	2,468
Other	23,756	--	23,756
Total	26,224	-	26,224

* Other includes employees only, for retention column.

Daily User Population for Development Alternatives

Table 1b

Origin User	On Site	Downtown	Outside Downtown	Total
2 Million				
Office Employees	(29)	101	1,323	1,424[1]
Business Visitors	-	29	116	145
Retail Employees	-	4	194	198
Hotel Employees	0	0	0	0
Residents	494	-	-	494
Hotel Occupants	0	0	0	0
Shoppers (Fall)	-	2,000	0	2,000
Total	494[1]	2,134	1,633	4,261
3 Million Alternative (New Development Only)				
Office Employees	(46)	159	2,070	2,229[1]
Business Visitors	-	46	182	228
Retail Employees	-	17	819	836
Hotel Employees	-	8	374	382
Residents	1,125	-	-	1,125
Hotel (Fall, High Estimate)	787	-	-	787
Shoppers (Fall)	-	2,917	4,128	7,045
Total	1,912[1]	3,147	7,573	12,632
4 Million (New Development Only)				
Office Employees	(90)	316	4,107	4,423[1]
Business Visitors	-	90	361	451
Retail Employees	-	21	1,037	1,058
Hotel Employees	-	14	680	694
Residents	1,493	-	-	1,493
Hotel Occupants (Fall)	1,573	-	-	-
Shoppers (Fall)	-	3,440	4,801	8,241
Total	3,066[1]	3,881	10,986	17,933

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[1] Excludes office employees who live in Park Plaza to avoid double counting.

Table 1(Cont'd)

5 Million (New Development Only)

User	Origin On Site	Downtown	Outside Downtown	Total
Office Employees	(158)	554	7,204	7,758
Business Visitors	-	158	634	792
Retail Employees	-	27	1,323	1,350
Hotel Employees	-	14	680	694
Residents	1,628	-	-	1,628
Hotel	1,573	-	-	1,573
Shoppers	-	4,487	6,955	11,442
Total	3,201[1]	5,240	16,796	25,237

6 Million Alternative

User	Origin On Site	Downtown	Outside Downtown	Total
Office Employees	(168)	527	6,840	7,367
Business Visitors	-	151	603	754
Retail Employees	-	30	1,447	1,477
Hotel Employees	-	14	680	694
Residents	2,468	-	-	2,468
Hotel (Fall- High Estimate)	1,573	-	-	1,573
Shoppers (Fall)	-	4,487	7,404	11,891
Total	4,041[1]	5,209	16,974	26,224

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[1] Excludes office employees who live in Park Plaza to avoid double counting.

242

Table 2

Park Plaza Apartment Residents

	Coefficient	2M	3M	4M	5M	6M
No. of Units		320	750	995	1,085	1,645
No. of Luxury Units	80%	256	600	796	868	1,316
No. of Occupants	1.6 per unit	410	960	1,274	1,389	2,106
% Working[1]	80%	328	768	1,019	1,111	1,684
Location of Work[2]						
Park Plaza	10%	33	77	102	139	168
Downtown	50%	164	384	510	694	842
Outside Downtown	40%	131	307	408	555	674
Median Household Income	$26,000					
Per Capita Income	$18,750					
. of Elderly Units	20%	76	150	199	217	329
No. of Occupants	1.1 per unit	84	165	219	239	362
Median Household Income	$6,084					
Per Capita Income	$5,530					
Total Apartment Residents		494	1,125	1,493	1,628	2,468

Source: Bob Earsy, Boston's New High Rise Apartments: A Study of the Residents and their Preferences, January 1974.

Based on the BRA Research Department Report, The Prudential Towers and Charles River Park Apartments: The Effect of High Rise on Boston's Population, July 1970.

Table 3

Resident Population Characteristics, Luxury Units

Sex	
Male	48%
Female	52%
Income	
Median Income $26,000	
Occupation	
Professional and Technical	42%
Managerial	34%
Clerical	13%
Sales	6%
Operatives	3%
Other	2%
Marital Status	
Never married	39%
Married	40%
Separated	2%
Widowed	12%
Divorced	6%
Age	
Under 18	6%
18-30	20%
30-60	50%
Over 60	24%

Source: Park Plaza Projected Characteristics of Residents, Office Workers, Retail Employees, Hotel Occupants and Hotel Employees, Economic Research Associates, March 21, 1975.

Table 4

Employment

Office	Coefficient	2M	3M	4M	5M	6M
Gross Square Feet		351,500	550,635	1,092,000	1,915,500	1,823,500
Gross Leasable Area	87%	305,805	479,052	950,040	1,666,485	1,586,400
Occupancy	95%	290,515	455,100	902,538	1,583,161	1,507,080
No. of Employees	(200 sq.ft. per worker)	1,453	2,275	4,513	7,916	7,535
Origin of Employees[1]						
Park Plaza	2%	29	46	90	158	168
Downtown	7%	101	159	316	554	527
Outside Downtown	91%	1,323	2,070	4,107	7,204	6,840
Hotel						
No. of Rooms			406	810	810	810
No. of Employees	837 sq.ft.	0	382	694	694	694
Origin of Employees						
Downtown	2%	0	8	14	14	14
Boston	58%		221	403	403	403
Outside Boston	40%		153	277	277	277
Retail						
Total Square Feet		47,000	199,050	252,000	321,000	352,000
No. of Employees	238 sq.ft.	198	836	1,058	1,350	1,477
Downtown	2%	4	17	21	27	30
Boston	50%	99	418	529	675	738
Outside Boston	48%	95	401	508	648	709
Total Employment						
Total # of Employees		1,651	3,493	6,266	9,960	9,706
Origin of Employees						
Park Plaza		29	46	90	158	168
Downtown		105	184	366	595	571
Outside Downtown		1,517	3,263	5,816	9,207	

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[1] Robert Earsy, Kent Colton, BRA Research Department, Boston's New High-Rise Office Buildings: A Study of the Employees and their Housing Preferences, July 1974.

Table 5

1985 Characteristics of Employees

	Retail Employees	Office Workers	Hotel Employees
Sex			
Male	54%	50%	52%
Female	46%	50%	48%
Income			
Less than 5,500	20%	5%	30%
5,500 to 9,999	70%	42%	69%
10,000 to 21,000	8%	40%	.8%
Over 21,000	2%	13%	.2%
Occupation			
Professional & Technical	6%	26%	4%
Managerial	10%	15%	2%
Clerical	30%	48%	7%
Sales	30%	5%	.7%
Operatives	7%	1%	.3%
Other	17%	5%	86%
Age			
Under 25		26%	25%
25-40		45%	45%
Over 40		29%	30%

Source: Economic Research Associates, Park Plaza Projected Characteristics,

Table 6

Hotel Occupants 4M, 5M, 6M
(810 rooms)

Average Annual Total Occupants

Low	(75 percent occupancy	1.2 persons per room)	266,085
High	(85 percent occupancy	1.6 persons per room)	402,100

Weekend versus Weekday Occupancy Levels
Equal for All Anticipated Occupancy Levels

Average Quarterly Occupancy

		Low	High
Winter	11%	29,270	44,230
Spring	20%	53,220	80,420
Summer	33%	87,810	132,690
Fall	36%	95,790	144,760

Average Daily Occupancy

Winter	(90 days)	325	491
Spring	(91 days)	585	883
Summer	(92 days)	955	1,440
Fall	(92 days)	1,040	1,573

100% Occupancy at Two Persons per Room - 1,620

Source: Economic Research Associates, Park Plaza Projected Characteristics

Table 7

Hotel Occupants 3M Alternative
(406 rooms)

Average Annual Total Occupants

Low	(75 percent occupancy 1.2 persons per room)	133,043
High	(85 percent occupancy 1.6 persons per room)	201,050

Weekend versus Weekday Occupancy Levels

Equal for All Anticipated Occupancy Levels

Average Quarterly Occupancy

		Low	High
Winter	11%	14,635	22,115
Spring	20%	26,610	40,210
Summer	33%	43,905	66,345
Fall	36%	47,895	72,380

Average Daily Occupancy

		Low	High
Winter	(90 days)	163	246
Spring	(91 days)	293	442
Summer	(92 days)	478	720
Fall	(92 days)	520	787

100% occupancy at two persons per room - 810.

The number of hotel rooms for the 3 million alternative is one half that of the 6 million alternative. I have halved ERA's figures for hotel occupancy.

Source: Economic Research Associates

Table 8

Summary Table of Shoppers in Park Plaza

Origin	6 Million		5 Million		4 Million		3 Million		2 Million	
	Average	Peak (Fall)	Average	Peak	Average	Peak	Average	Peak	Average	Peak
On Site	-	-	-	-	-	-	-	-	-	-
Downtown	3,225	4,487	3,225	4,487	2,473	3,440	2,096	2,917	1,500	2,000
Outside Downtown	5,323	7,404	5,000	6,955	3,451	4,801	2,968	4,128	-	-
Total	8,548	11,891	8,225	11,442	5,924	8,241	5,064	7,045	1,500	1,500

Source: "Park Plaza Daily User Population", BRA Research Dept., May 1975.

Table 9

Retail Space in Park Plaza

	2M	3M	4M	5M	6M
Retail & Personal Services	37,000	59,050	75,000	141,000	183,097
Department Store	0	100,000	135,000	135,000	100,000
Total Retail	37,000	159,050	210,000	276,000	283,097
Banks, etc.	10,000	40,000	42,000	45,000	40,000
Total	47,000	199,050	252,000	321,000	323,097

GROUP STRUCTURE

GROUP STRUCTURE

Within the project area itself, there are these service organizations:

Seamen's Friends Society (a small hotel for visiting foreign seamen, which is church affiliated and endowed, and now occupies 20,000 sq. ft. on Park Square.

Women's Educational and Industrial Union (a women's non-profit organization occupying 32,000 sq. ft. in three buildings along Boylston Street with a small arts and crafts retail shop and approximately 60 employees. Indications are that the WEIU may be relocating, voluntarily, within the near future.

Massachusetts Law Reform Institute

Lawyers' Commission for Civil Rights

Al-Anon Intergroup Council

All of these organizations would be affected by the development alternatives (except the WEIU under the 3 and 4 million Alternatives).

POLITICAL STRUCTURE

For a description of any significant environmental impacts, refer to Chapter 6 - Testing and Evaluation.

FUNCTIONAL SERVICES

FUNCTIONAL SERVICES

EDUCATION

Estimates of maximum school age population associated with each project alternative assumes 100 percent public school attendance. In reality the pattern in Boston is considerably less, about 60 percent.

School Age Pop.	6 mil alt	5 mil alt	4 mil alt	3 mil alt	2 mil alt
Total Pop.	2,106	1,628	1,493	960	494
School Age Pop (0-18)	126	98	90	57	30
Distribution					
0-6 35%	45	34	31	21	11
6-12 (elementary) 25%	31	24	23	14	7
12-15 (middle) 20%	25	20	18	11	6
15-18 (high) 20%	25	20	18	11	6

POLICE

Estimating the probably demand for police services for each of the alternatives is not eaily quantifiable. Crime analysis data suggests that there is no reliable correlation between population size or building type and crime levels.

One can point to the effect that each alternative will have on the factors which are considered closely related to the crime level.

Possible Contributing Factors	Effect Under:		
	5.6 mil	3.4 mil	2 mil
Adult Entertainment uses	eliminated	eliminated	would remain
Transients attracted to the bus station	eliminated	eliminated	eliminated
Carver St., Boylston Place alleyways.	eliminated	would remain	would remain

FIRE

All available evidence, both local and national, indicates that the incidence of fire is reduced substantially in new construction.* State building and fire codes have made the use of fire-proof building materials standard practice. Further, fire suppression is aided by smoke control devices, centralized alarm systems, elevator safety devices, and sprinkler systems.

The results of such techniques on the demand for fire services can be appreciated by comparing the existing Park Plaza area's pattern of alarms with the Prudential Center's. (While the time periods are not identical, the magnitude of the difference tends to make the point.)

Area	Number of alarm responses	Time period
Park Plaza	173	Jan-March 1975
Prudential	13	Jan-May 1973

Along with the probably reduction in alarm calls, fewer inspection visits would be expected for the new buildings, again resulting in reduction in the demand for fire protection services.

Some additional fire fighting protection will be required, however, in connection with new construction. For any of the build alternatives a new high pressure water supply system is planned along the perimeter of the urban renewal area. Such a system would be reserved exclusively for fire fighting, and is considered by the Fire Department to be an essential adjunct to fire protection in high rise areas for the City. A description and estimate of capital costs for this system is contained in the public utilities section.

* (Although it is conceded that the severity-potential may in fact increase.)

SOLID WASTE

Estimated volumes of solid waste for each of the development alternatives are stated below. Estimates are based on the following consumption factors per day: residents - 5 lbs. per capita; office - 1.2 lbs. per employee; retail - .3 lbs. per sq. ft.; and hotel - 2 lbs. per room.

Estimated Maximum Volume	Alternatives:				
	6 mil	5 mil	4 mil	3 mil	2 mil
Tons per Day	64.2	62.6	54.4	34.4	23.3
Tons per Year	19,492	18,882	16,497	10,463	7,031

There are a number of techniques available for processing these quantities of waste which are economically efficient and would reduce on-site health hazards. With the high ratio of development space to land area, some form of centralized collection system could be installed, similar to AVAC (a pneumatic waste collection system pioneered in Sweden). A more conventional approach would be to containerize waste from each building. In either case, some form of compaction and/or shredding would be required for containerization and should be encouraged.

HEALTH

Projected hospital patient days per thousand population by age group and sex is estimated to be:

Age	Patient Days/Thousand Male	Patient Days/Thousand Female
0-15	315	274
15-24	745	1,029
25-44	698	1,125
45-64	1,366	1,022
65-74	1,920	1,504
75+	1,945	1,924

(Source: Planning Design Criteria, Larry DeChiara)

For Park Plaza, the estimated hospital patient days for each alternative and the total hospital beds* required is:

Alternative	Number of Patient Days	Number of Beds Required
6 mil	2,500	9
5 mil	1,700	7
4 mil	1,500	6
3 mil	1,200	4
2 mil	500	2

(*Out-patient demands not included)

SOCIAL SERVICES - ELDERLY POPULATION

As one of the assumptions incorporated into the building mass study, each of the alternatives would include 20 percent elderly housing. This has been done in response to the need felt by some to have the residential population more heterogeneous than otherwise would be the case with luxury housing exclusively. The goal to have mixed income and age groups within the project has also been an implied BRA planning objective for some time.

Accordingly, the project alternatives would include the following numbers of elderly:

6 mil sq. ft.	362
3 mil sq. ft.	239
4 mil sq. ft.	219
5 mil sq. ft.	165

Based on eligibility guidelines promulgated by Mass. Housing Finance Agency - a possible funding source for an elderly project - these residents would be drawn from the entire metropolitan area and not simply the immediate neighborhoods. Thus no immediate neighborhood housing needs for the elderly would be automatically served.

PUBLIC ECONOMIC STRUCTURE

PRIVATE ECONOMIC STRUCTURE

ANALYSIS OF THE ECONOMIC BENEFITS AND PUBLIC COSTS FOR PARK PLAZA

The analysis which follows attempts to quantify the direct economic benefits the City can expect to derive from the five development alternatives for the Park Plaza site. It compares these benefits with the direct and indirect public costs for the capital improvements and public services and facilities associated with each of the development alternatives. It also compares the economic benefits generated by each of the five development alternatives with the existing base of the site.

The basic purpose of the analysis is to quantify the net impacts on the City's economic and fiscal position and compare the "economic trade-offs" between each of the development alternatives.

The analysis is presented in the preceding series of summary tables. The tables are relatively straightforward and generally follow in a chronological sequence. A detailed explanation of the sources and methodology used in each of the tables appears in an attached appendix in this section.

The approach in the analysis was to evaluate the direct economic benefits and direct and indirect public costs for each of the alternatives at two time periods. During the construction phase and in the first year after the completion of the entire development. Although this approach falls short of a full-scale cost-benefit evaluation of a development over its entire economic life span, it does provide the necessary information to properly evaluate and compare the public cost and benefits associated with each of the proposed alternatives.

Another deletion from the cost-benefit analysis is an evaluation of the indirect economic benefits or spinoff effects that would be generated by the development in the surrounding Downtown area. We felt that the current quality of available information on indirect benefits of new development was so inadequate or outdated that it would be very speculative and inappropriate to include in this analysis. By comparing only the direct (measurable) economic benefits with the direct and indirect public cost, the benefit/cost ratios are probably very conservative and represent the minimum return that can be expected from the new development.

In addition, in estimating the cost for public services and facilities, we based the cost on the density of development. Thus, as density increases, public services cost would increase proportionately. This approach probably greatly overestimates the cost for certain services such as police and fire services which are more closely related to things such as the type of night-time activity, the age and quality of buildings in the area, etc. It is very likely, for example, that with new development the cost of fire services in the area are actually reduced. In fact, according to a recent study done for the San Francisco Bay Regional Planning Commission, on the Impact of Intensive High-Rise Development on San Francisco, the cost for fire services on a per 1000/square foot basis was reduced significantly with new high-rise development.

The public service costs calculated for each of the development alternatives should be viewed as the development's "share" of the City's total public service costs. It should be understood, as such, these costs are theoretical allocations and not direct out-of-pocket costs generated by the development.

The impact analysis that is presented in the tables and appendix covers five basic points: the first section, Tables I, II, III and IV, analyzes the combined public and private capital investment required under each of the alternatives, and the direct economic impact generated by these capital expenditures, in terms of construction jobs, payroll and tax revenues.

The second section, Tables V and V(A), presents the direct economic benefits generated by the various development alternatives in terms of sales, permanent employment, payroll and State and City tax revenues. Table V summarizes these benefits by alternatives, while Table V(A) breaks down for each of the alternatives, the economic benefits generated by the various land uses.

In the third section, Table VI, a comparison is made between the benefits generated by the existing economic base and the benefits that would be generated under each of the five development alternatives.

The fourth section, Tables VII and VIII, analyzes the direct and indirect cost for public services and facilities for each of the alternatives and for each of the development components.

In reviewing the benefit/cost ratios it is important to keep in mind that they represent the most "conservative estimates" of return to the City. They reflect only the direct benefits measured against both direct and indirect public cost. Furthermore, the method by which we estimated public service cost probably overestimates the actual cost directly associated with the new development on the Park Plaza site. The high benefit/cost ratio for the "No build" or 2 Million Alternative, clearly reflects the built-in biases of the methodology. Under the no build - (2 Million Alternative) it is assumed that there is no direct public investment in the area and since the density of area is actively lowered under the 2 Million Alternative, the public service costs are proportionately lower. If we add in just the public investment for New Charles Street and the $840,000 for the new sewer under the Garden, the benefit/cost ratios will change dramatically for the 2 Million Alternative. The benefit/cost ratio will go from the current 2.33, (comparing total revenue and the total cost) to 1.57 with these public improvements. For the property tax/total cost, the ratio slips from 1.86 to 1.25.

The fifth section, Table IX, compares the direct annual tax revenues generated by each of the proposed developments with the total annual public cost for debt servicing (for the capital expenditures) and the direct and indirect cost for public services and facilities. A set of benefit/cost ratios summarizes this comparison.

Summary Table I

PUBLIC AND PRIVATE CAPITAL INVESTMENT

Sector	Total Development Cost, by Alternative				
Private:	6 Million	5 Million	4 Million	3 Million	2 Million
1. Retail	$ 22,173,795	$ 20,208,195	$ 15,839,145	$ 12,540,150	$ 2,971,960
2. Office	116,030,800	121,883,880	72,850,035	45,625,900	25,355,675
3. Hotel	49,532,000	49,532,000	49,532,000	19,488,000	-
4. Residential	87,514,000	57,722,000	52,934,000	39,900,000	17,384,000
5. Parking	22,543,200	14,803,200	11,340,000	11,340,000	-
Total Private:	$297,793,795	$264,149,275	$202,495,180	$128,894,050	$45,711,635
Public (City)					
Total Direct Cost:	$ 16,304,415	$ 16,120,220	$ 16,120,220	$ 18,640,710	0
- (For Streets and Improvements)					
Total Public and Private Investment:	$314,098,210	$280,269,495	$218,615,400	$147,534,760	$45,711,635

Source:

See Appendix - Table I for sources and methods. A detail breakdown of Public Capital Cost appears in Tables III and IV.

Summ Table II

DIRECT IMPACT OF CONSTRUCTION ACTIVITY FROM PUBLIC AND PRIVATE DEVELOPMENT

	Private Development	6 Million	5 Million	4 Million	3 Million	2 Million
1.	Total Construction Man Years	4,005	3,492	2,665	1,684	590
2.	Avg. Annual Construction Jobs	445	388	410	259	236
3.	Total Construction Payroll (in millions of dollars)	$56.1	48.9	37.3	23.6	8.3
4.	Avg. Annual Payroll (in millions of dollars)	$6.2	5.4	5.7	3.6	3.3
	Public Development					
1.	Total Construction Man Years	145	140	140	140	-
2.	Avg. Annual Construction Jobs	42	40	40	40	-
3.	Total Construction Payroll	$2.0	2.0	2.0	2.0	-
4.	Avg. Annual Payroll	$.6	.6	.6	.6	-
	Total Public and Private					
1.	Total Construction Man Years	4,150	3,632	2,805	1,824	590
2.	Avg. Annual Construction Jobs	487	428	450	299	236
3.	Total Construction Payroll	$58.1	50.9	39.3	25.6	8.3
4.	Avg. Annual Payroll	$6.8	6.0	6.3	4.2	3.3
5.	Multiplier Effect: (in million of dollars)	$13.6	$12.0	$12.6	$8.4	$6.6
6.	Tax Revenues:					
	State	$340,000	$300,000	$215,000	$210,000	$615,000
	City	$ 37,400	$ 33,000	$ 34,650	$ 23,100	$ 18,150

Source: Wolf and Co., Report On Park Plaza'a Impact On Construction Employment, June 1975.

Also: See Appendix for Table II for further details.

221

Summary Table III

ANALYSIS OF PUBLIC COSTS FOR PARK PLAZA DEVELOPMENT

IN THE DEVELOPMENT PHASE

	Direct Cost For Public Improvements	Development Alternatives			
		6 Million	5 Million	4 Million	3 Million
1.	Land Acquisition (net cost)	$ 2,168,710	$ 2,168,710	$ 2,168,710	$ 3,666,775
2.	Relocation	800,000	800,000	800,000	800,000
3.	Demolition and Site Preparation	308,300	308,300	308,300	308,300
4.	Construction/Improvements	4,049,750	3,940,430	3,940,430	3,940,430
5.	Legal and Engineering Fees	1,255,420	1,221,530	1,221,530	1,221,530
6.	Contingencies and Inflation	1,193,820	1,142,140	1,142,140	1,142,140
	Subtotal	$ 9,690,430	$ 9,581,110	$ 9,581,110	$11,079,175
7.	Debt Servicing (interest cost) (6½%, 20 years)	$ 6,613,720	$ 6,539,110	$ 6,539,110	$ 7,561,535
	Total Direct Cost	$16,304,415	$16,120,220	$16,120,220	$18,640,710
	Indirect Cost				
8.	Total Property Tax Loss (wgt. Avg.)	$ 2,215,395	$ 2,106,905	$ 1,569,755	$ 1,444,565
9.	Total Job Dislocation	1,532	1,490	955	595
10.	Net Job Loss to City (30%)	460	450	290	180

See Appendix for Table III and Table III (A) and Table III (B) for Sources and Methods.

Summary Table IV

ANALYSIS OF PUBLIC COST FOR PARK PLAZA DEVELOPMENT IN THE DEVELOPMENT PHASE

Public Improvements	Development Costs (1)			
	6 Million	5 Million	4 Million	3 Million
New Charles Street	$4,103,210	$4,103,210	$4,103,210	✓$ 5,601,275
Other Street and Sidewalk Improvements	967,750	967,750	967,750	967,750
Street Lighting	302,980	302,980	302,980	302,980
Low and High Service Water System	756,560	756,560	756,560	756,560
High Pressure Fire System	671,010	671,010	671,010	671,010
Sanitary Sewer and Surface Drainage	1,740,170	1,740,170	1,740,170	1,740,170
Police and Fire Alarm	110,320	110,320	110,320	110,320
Traffic Control Systems and Signs	89,110	89,110	89,110	89,110
Mitigation of St. James Street				
Sewer Surcharge	109,320	-	-	-
Mitigation of Public Garden (2)				
Combined Sewer Surcharge (30% of total cost)	840,000	840,000	840,000	840,000
Total:	$9,690,430	$9,581,110	$9,581,110	$11,079,175

Source:

1. BRA Engineering Department, update, June 1975.
2. C. T. Main Report, June 1975.

Also: See Appendix for Table III for further details.

Summary Table V

ECONOMIC IMPACT OF PARK PLAZA DEVELOPMENT

Direct Economic Impact of New Development after Completion

	Alternative Developments				
	6M	5M	4M	3M	2M
Average Annual Sales	$ 65,592,565	$ 63,535,965	$ 51,192,550	$ 44,101,497	$ 15,718,510
Average Annual Employment	9,744	10,166	7,730	6,164	4,245
Average Annual Payroll	$115,377,500	$120,889,000	$ 78,403,400	$ 71,718,000	$ 51,172,500
Multiplier Effect 1	$230,755,000	$241,778,000	$156,806,800	$143,436,000	$102,345,000
Total Annual Tax Revenue:					
- State	$ 13,111,394	$ 12,782,151	$ 9,469,374	$ 7,914,130	$ 4,781,021
- City 2	$ 9,459,896	$ 8,770,695	$ 6,548,736	$ 4,970,773	$ 2,658,550
- (Property Tax) a	($ 7,969,321)	($ 7,317,943)	($ 5,468,875)	($ 4,065,494)	($ 2,119,980)

Source: See Appendix for Table V and Table V (A) for detail breakdown of components, sources and methodology.

1. Multiplier effect is the impact of payroll expenditures on the local and regional economy. We applied a multiplier of 2.5 on disposable income generated from the Average Annual Payroll.

2. Total Annual City Tax Revenues include property tax and the City's share of State's sales, meals, business excise and personal income tax.

a. Property taxes are broken out for comparative purposes. Total Annual Tax Revenues for the State and City cam be calculated by adding the State Tax Revenues to the City's property taxes.

Table V (A)

DIRECT ECONOMIC IMPACT OF NEW DEVELOPMENT AFTER COMPLETION *
(A - 1)

6 Million Alternative

		1 Retail	2 Office	3 Hotel	4 Residential	5 Parking	6 Total
1.	Average Annual Sales	$45,966,625	-	16,808,040	-	2,817,900	$ 65,592,565
2.	Average Annual Employment	1,485	7,550	694	-	15	9,744
3.	Average Annual Payroll	$11,880,000	98,150,000	5,205,000	-	142,500	$115,377,500
4.	Total Annual Tax Revenue:						
	- State	$ 2,552,747	7,001,367	1,497,690	2,034,430	25,160	$13,111,394
	- City	$ 1,279,427	4,937,722	570,748	2,105,651	566,348	$9,459,896
	- (Property Tax)	($950,305)	(4,167,572)	(406,000)	(1,881,846)	(563,580)	($7,969,321)

Breakdown of Annual Tax Revenues

	Tax	State	City of Boston
1.	Property Tax	-	$7,969,321
2.	Sales and Room Occupancy Tax	$1,740,213	239,742
3.	Meals Tax	1,054,217	115,966
4.	Business Excise Tax	2,513,659	276,504
5.	Personal Income Tax	7,803,305	858,363
	Total	$13,111,394	$9,459,896

* See Apendix to Table V for details on sources and methodology.

Table (A)

5 Million Alternative
(A - 2)

		1 Retail	2 Office	3 Hotel	4 Residential	5 Parking	6 Total
1.	Average Annual Sales	$44,877,525	-	16,808,040	-	1,850,400	$ 63,535,965
2.	Average Annual Employment	1,470	7,990	694	-	12	10,166
3.	Average Annual Payroll	$11,700,000	103,870,000	5,205,000	-	114,000	$120,889,000
4.	Total Annual Tax Revenue:						
	- State	$ 2,515,689	7,409,393	1,497,690	1,341,837	17,542	$ 12,782,151
	- City	$ 1,230,975	5,208,093	570,748	1,388,879	372,000	$ 8,770,695
	- (Property Tax)	($907,526)	(4,393,060)	(406,000)	(1,241,277)	(370,080)	($ 7,317,943)

Breakdown of Annual Tax Revenues

	Tax	State	City of Boston
1.	Property Tax	-	$7,317,943
2.	Sales and Room Occupancy Tax	$ 1,700,306	233,756
3.	Meals Tax	1,073,036	118,034
4.	Business Excise Tax	2,622,522	288,477
5.	Personal Income Tax	7,386,287	812,492
	Total	$12,782,151	$8,770,702

Table V (A)

4 Million Alternative
(A - 3)

		1 Retail	2 Office	3 Hotel	4 Residential	5 Parking	6 Total
1.	Average Annual Sales	$38,558,826	-	16,808,040	-	1,512,000	$51,192,550
2.	Average Annual Employment	1,290	5,738	694	-	8	7,730
3.	Average Annual Payroll	$10,205,000	62,917,400	5,205,000	-	76,000	$78,403,400
4.	Total Annual Tax Revenue:						
	- State	$ 2,239,396	4,488,107	1,497,690	1,230,705	13,476	$ 9,469,374
	- City	$ 1,042,577	3,358,107	570,748	1,273,649	303,655	$ 6,548,736
	- (Property Tax)	($757,790)	(2,864,416)	(406,000)	(1,138,269)	(302,400)	($ 5,468,875)

Breakdown of Annual Tax Revenues

	Tax	State	City of Boston
1.	Property Tax	-	$5,468,875
2.	Sales and Room Occupancy Tax	$1,493,636	202,755
3.	Meals Tax	1,118,607	124,046
4.	Business Excise Tax	1,706,256	187,691
5.	Personal Income Tax	5,150,875	566,369
	Total	$9,469,374	$6,548,736

Table (A)

3 Million Alternative
(A - 4)

		1 Retail	2 Office	3 Hotel	4 Residential	5 Parking	6 Total
1.	Average Annual Sales	$35,535,725	-	7,053,772	-	1,512,000	$44,101,497
2.	Average Annual Employment	1,219	4,555	382	-	8	6,164
3.	Average Annual Payroll	$ 9,562,000	59,215,000	2,865,000	-	76,000	$71,718,000
4.	Total Annual Tax Revenue:						
	- State	$ 2,092,021	4,224,002	657,261	927,370	13,476	$ 7,914,130
	- City	$934,591	2,497,247	275,298	959,982	303,655	$ 4,970,773
	- (Property Tax)	($669,517)	(2,032,605)	(203,000)	(857,972)	(302,400)	($ 4,065,494)

Breakdown of Annual Tax Revenues

	Tax	State	City of Boston
1.	Property Tax	-	$4,065,494
2.	Sales and Room Occupancy Tax	$1,110,306	157,090
3.	Meals Tax	745,021	81,953
4.	Business Excise Tax	1,545,503	170,027
5.	Personal Income Tax	4,513,300	496,209
	Total	$7,914,130	$4,970,773

Table V (A)

2 Million Alternative

(A - 5)

		1 Retail	2 Office	3 Hotel	4 Residential	5 Parking	6 Total
1.	Average Annual Sales	$14,668,510	-	-	-	1,050,000	$15,718,510
2.	Average Annual Employment	540	3,700	-	-	5	4,245
3.	Average Annual Payroll	$ 4,150,000	46,975,000	-	-	47,500	$51,172,500
4.	Total Annual Tax Revenue:						
	- State	$947,443	3,350,883	-	473,600	9,095	$ 4,781,021
	- City	$350,417	1,661,037	-	436,096	211,000	$ 2,658,550
	- (Property Tax)	($233,540)	(1,292,440)	-	(384,000)	(210,000)	($ 2,119,980)

Breakdown of Annual Tax Revenues

	Tax	State	City of Boston
1.	Property Tax	-	$2,119,980
2.	Sales and Room Occupancy Tax	$ 316,450	47,467
3.	Meals Tax	329,615	36,260
4.	Business Excise Tax	1,102,731	121,300
5.	Personal Income Tax	3,032,225	333,543
	Total	$4,781,021	$2,658,550

Table V (A)

Existing Base

(A - 6)

		1 Retail	2 Office	3 Residential	4 Parking	5 Total
1.	Average Annual Sales	$19,476,000	-	-	1,171,800	$20,647,800
2.	Average Annual Employment	898	618	-	15	1,531
3.	Average Annual Payroll	$ 7,184,000	$6,798,000	-	127,500	$14,109,500
4.	Total Annual Tax Revenue:					
	- State	$ 1,408,956	479,900	13,500	13,875	$ 1,916,231
	- City	$613,775	976,816	20,382	235,885	$ 1,846,855
	- (Property Tax)	($442,600)	(925,025)	(18,894)	(234,360)	($ 1,620,879)

Breakdown of Annual Tax Revenues

	Tax	State	City of Boston
1.	Property Tax	-	$1,630,879
2.	Sales and Room Occupancy Tax	$379,782	56,967
3.	Meals Tax	545,328	59,986
4.	Business Excise Tax	272,146	29,936
5.	Personal Income Tax	718,975	79,087
	Total	$1,936,231	$1,846,855

Summary Table VI

ECONOMIC IMPACT OF PARK PLAZA DEVELOPMENT

Net Direct Economic Impact of New Development After Completion *
(In millions of Dollars)

6 Million Alternative

	Current Level	Level with New Development	Net Gain
Average Annual Sales	$20.6	65.6	$ 45.0
Average Annual Employment	1,531	9,744	8,213
Average Annual Payroll	$14.1	115.4	$101.3
Multiplier Effect	$28.2	230.8	$202.6
Annual Tax Revenue			
- State	$ 1.9	13.1	$ 11.2
- City	$ 1.8	9.5	$ 7.7
- (Property Tax)	($ 1.6)	(8.0)	($ 6.4)

* Sources: Summary Table V and Table V (A)

Table VI (cont.)

5 Million Alternative

	Current Level	Level with New Development	Net Gain
Average Annual Sales	$20.6	63.5	$ 42.9
Average Annual Employment	1,531	10,166	8,635
Average Annual Payroll	$14.1	120.9	$106.8
Multiplier Effect	$28.2	241.8	$213.6
Annual Tax Revenue			
- State	$ 1.9	12.8	$ 10.9
- City	$ 1.8	8.8	$ 7.0
- (Property Tax)	($ 1.6)	(7.3)	($ 5.7)

4 Million Alternative

	Current Level	Level with New Development	Net Gain
Average Annual Sales	$20.6	51.2	$ 30.6
Average Annual Employment	1,531	7,730	6,199
Average Annual Payroll	$14.1	78.4	$ 64.3
Multiplier Effect	$28.2	156.8	$128.6
Annual Tax Revenue			
- State	$ 1.9	9.5	$ 7.6
- City	$ 1.8	6.5	$ 4.7
- (Property Tax)	($ 1.6)	(5.5)	($ 3.9)

Table VI (cont.)

3 Million Alternative

	Current Level	Level with New Development	Net Gain
Average Annual Sales	$20.6	44.1	$ 23.5
Average Annual Employment	1,531	6,164	4,633
Average Annual Payroll	$14.1	71.7	$ 57.6
Multiplier Effect	$28.2	143.4	$115.2
Annual Tax Revenue			
- State	$ 1.9	7.9	$ 6.0
- City	$ 1.8	5.0	$ 3.2
- (Property Tax)	($ 1.6)	(4.1)	($ 2.5)

2 Million Alternative

	Current Level	Level with New Development	Net Gain
Average Annual Sales	$20.6	15.7	-$ 4.9
Average Annual Employment	1,531	4,245	2,714
Average Annual Payroll	$14.1	51.2	$37.1
Multiplier Effect	$28.2	102.3	$74.1
Annual Tax Revenue			
- State	$ 1.9	4.8	$ 2.9
- City	$ 1.8	2.7	$ .9
- (Property Tax)	($ 1.6)	(2.1)	($ .5)

Table XI

DIRECT AND INDIRECT COST FOR PUBLIC SERVICES AND FACILITIES FOR THE PARK PLAZA DEVELOPMENT

(After Completion)

	Development Alternative				
Development Use:	6 Million	5 Million	4 Million	3 Million	2 Million
Retail	$ 504,435	$ 485,720	$ 442,277	$406,060	$181,785
Office	1,417,585	1,503,880	1,021,815	759,980	612,290
Hotel	880,720	880,720	880,720	347,030	NA
Residential	1,714,490	1,148,210	1,050,815	787,075	346,640
Total	$4,517,230	$4,018,530	$3,395,627	$2,300,145	$1,140,715

Public Services	6 Million	5 Million	4 Million	3 Million	2 Million
1. Police Protection	$ 856,245	$ 789,960	$ 691,632	$ 447,790	$ 211,790
2. Fire Protection	644,055	567,790	480,615	330,960	174,535
3. Public Works	317,210	265,980	226,625	159,455	83,225
4. Traffic and Parking	28,995	26,265	21,940	15,090	8,265
5. MBTA Deficit	487,560	478,660	395,890	294,655	163,860
6. Parks and Recreation	373,800	329,700	273,000	178,500	84,000
7. County Court	158,565	135,775	115,875	86,445	44,840
8. Education	39,000	27,000	24,000	18,000	7,500
9. Public Housing	65,800	43,400	39,800	30,000	15,200
10. Community-Wide City Services	1,546,000	1,354,000	1,126,250	741,250	347,500
Total	$4,517,230	$4,018,530	$3,395,627	$2,300,145	$1,140,715

Source: See Table VIII and Appendix for Table VIII.

Table VIII

DIRECT AND INDIRECT COST FOR PUBLIC SERVICES AND FACILITIES IN PARK PLAZA

(After Completion)

		6 Million Alternative				
	Public Service/Facility	Retail	Office	Hotel	Residential	Total
1.	Police Protection	$112,640	$ 246,645	$259,840	$ 237,120	$ 856,245
2.	Fire Protection	52,800	210,105	121,800	259,350	644,055
3.	Public Works	19,360	87,700	44,660	165,490	317,210
4.	Traffic and Parking	2,465	10,965	5,685	9,880	28,995
5.	MBTA Deficit	135,520	200,970	89,320	61,750	487,560
6.	Parks and Recreation	31,500	126,000	69,300	147,000	373,800
7.	County Court	26,400	40,200	17,865	74,100	158,565
8.	Education	NA	NA	NA	39,000	39,000
9.	Public Housing	NA	NA	NA	65,800	65,800
10.	Community-Wide City Services	123,750	495,000	272,250	655,000	1,546,000
	Total:	$504,435	$1,417,585	$880,720	$1,714,490	$4,517,230

Source: Boston Municipal Research Bureau and Abt. Assoc. Inc., The Effect of High Density Development on Municipal Finance in the City of Boston, April 1974.

Also: See Appendix for Table VIII for additional sources and methodology.

5 Million Alternative

	Public Service/Facility	Retail	Office	Hotel	Residential	Total
1.	Police Protection	$113,280	$ 260,550	$259,840	$ 156,290	$ 789,960
2.	Fire Protection	53,100	221,950	121,800	170,940	567,790
3.	Public Works	19,470	92,640	44,660	109,210	265,980
4.	Traffic and Parking	2,480	11,580	5,685	6,520	26,265
5.	MBTA Deficit	136,290	212,300	89,320	40,750	478,660
6.	Parks and Recreation	27,300	134,400	69,300	98,700	329,700
7.	County Court	26,550	42,460	17,865	48,900	135,775
8.	Education	NA	NA	NA	27,000	27,000
9.	Public Housing	NA	NA	NA	43,400	43,400
10.	Community-Wide City Services	107,250	528,000	272,250	446,500	1,354,000
	Total	$485,720	$1,503,880	$880,720	$1,148,210	$4,018,530

4 Million Alternative

	Public Service/Facility	Retail	Office	Hotel	Residential	Total
1.	Police Protection	$106,672	$ 181,790	$259,840	$ 143,330	$ 691,632
2.	Fire Protection	47,190	154,860	121,800	156,765	480,615
3.	Public Works	17,300	64,635	44,660	100,030	226,625
4.	Traffic and Parking	2,200	8,080	5,685	5,975	21,940
5.	MBTA Deficit	121,120	148,125	89,320	37,325	395,890
6.	Parks and Recreation	25,200	88,200	69,300	90,300	273,000
7.	County Court	23.595	29,625	17,865	44,790	115,875
8.	Education	NA	NA	NA	24,000	24,000
9.	Public Housing	NA	NA	NA	39,800	39,800
10.	Community-Wide City Services	99,000	346,500	272;250	408,500	1,126,250
	Total	$442,277	$1,021,815	$880,720	$1,050,815	$3,395,627

	Public Service/Facility	Retail	Office	Hotel	Residential	Total
		3 Million Alternative				
1.	Police Protection	$ 97,600	$139,790	$102,400	$108,000	$ 447,790
2.	Fire Protection	45,750	119,085	48,000	118,125	330,960
3.	Public Works	16,775	49,705	17,600	75,375	159,455
4.	Traffic and Parking	2,135	6,215	2,240	4,500	15,090
5.	MBTA Deficit	117,425	113,905	35,200	28,125	294,655
6.	Parks and Recreation	21,000	63,000	27,300	67,200	178,500
7.	County Court	22,875	22,780	7,040	33,750	86,445
8.	Education	NA	NA	NA	18,000	18,000
9.	Public Housing	NA	NA	NA	30,000	30,000
10.	Community-Wide City Services	82,500	247,500	107,250	304,000	741,250
	Total	$406,060	$759,980	$347,030	$757,075	$2,300,145

	Public Service/Facility	Retail	Office	Residential	Total
		2 Million Alternative			
1.	Police Protection	$ 45,280	$119,085	$ 47,425	$ 211,790
2.	Fire Protection	21,225	101,440	51,870	174,535
3.	Public Works	7,785	42,340	33,100	83,225
4.	Traffic and Parking	1,000	5,290	1,975	8,265
5.	MBTA Deficit	54,480	97,030	12,350	163,860
6.	Parks and Recreation	8,400	46,200	29,400	84,000
7.	County Court	10,615	19,405	14,820	44,840
8.	Education	NA	NA	7,500	7,500
9.	Public Housing	NA	NA	15,200	15,200
10.	Community-Wide City Services	33,000	181,500	133,000	347,500
	Total	$181,785	$612,290	$346,640	$1,140,715

Table IX

A COMPARISON OF DIRECT TAX REVENUE BENEFITS WITH DIRECT AND INDIRECT PUBLIC COST FOR FIRST FULL YEAR AFTER COMPLETION

(in Thousands of Dollars)

	Development Alternatives				
Direct Revenues to City:	6M	5M	4M	3M	2M
roperty Tax	$7,969	$7,318	$5,469	$4,065	$2,120
ales and Room Occupancy Tax	240	234	203	157	47
eals Tax	116	118	124	82	36
usiness Excise Tax	277	288	188	170	121
ersonal Income Tax	858	812	566	496	334
Total Annual Tax Revenues:	$9,460	$8,770	$6,550	$4,970	$2,658
irect and Indirect Public Cost:	6M	5M	4M	3M	2M
nnual Debt Service on City's Capital Expenditures:[1]	$ 831	$ 822	$ 822	$ 950	$ 0
otal Direct and Indirect Public Service Cost:	4,517	4,019	3,396	2,300	1,141
Total Public Cost:	$5,348	$4,841	$4,218	$3,250	$1,141
Benefit/Cost Ratio's[2]	6M	5M	4M	3M	2M
otal Revenues/Total Cost	1.77	1.81	1.55	1.53	2.33
otal Revenues/Total Service Cost	2.09	2.18	1.93	2.16	2.33
roperty Tax Revenues/Total Cost	1.49	1.51	1.30	1.25	1.86
roperty Tax Revenues/Total Service Cost	1.76	1.82	1.61	1.77	1.86

Source: See Table V (A), Table IV and Table VIII.

1. Annual debt service cost represents the total annual debt service (principal and interest) in the 10th year, for capital expenditures for direct public improvements in Park Plaza (from Table IV).

2. Benefit/Cost Ratios represent direct revenues generated by the development for the City divided by the direct and indirect public cost.

APPENDIX
FOR
ECONOMIC BENEFIT AND PUBLIC COST ANALYSIS

APPENDIX
for
Table I

Sources and Methods:

Private Development Cost:

Development Cost For each development component includes land acquisition; demolition; relocation; site preparation and utilities; construction; legal, architecture, engineering fees; and a factor for contingencies and inflation.

1. Retail Space development cost was estimated at $63/s.f. for new developed space in each of the alternatives. The cost for upgrading of "retention space" was not included in the total development cost.

2. Office Space development cost was estimated at $74/s.f. of rentable space. An efficiency factor of 87% was applied to gross new office space to determine rentable space for each alternative. Office Space development cost is for new development only - upgrading of retention space was not calculated.

3. Hotel Costs were estimated at $61,000 per unit for the 4, 5 and 6 million alternatives and at $48,000/unit for the 3 million alternative.

4. Cost for Residential development was estimated at $59,000/unit for luxury apartments and $30,000/unit for elderly housing. In each alternative, 20% of the residential units were assumed to be for elderly housing.

5. Development Cost for the parking garage was estimated at $7,200/space.

Public Capital Cost:

Details of Public Cost for capital improvements appear in Tables III and IV and the Appendix to those Tables. It was assumed there would be no public capital cost for the 2 Million Alternatives.

APPENDIX
for
Table II

Sources and Methods:

Private Development:

Estimates for construction jobs generated by the 5 Park Plaza Alternatives are based on the special report prepared by the consultant firm of Wolf and Co. for Saratoga Associates and the BRA in June, 1975.

The Wolf report used two alternative models for determining construction job requirements. One model reflected a labor intensive design for the development and the other a non-labor intensive design.

The construction employment figures used in Table II reflect an Average of the employment figures determined by the two alternative methods.

1. Total Construction Man Years indicates the construction workers required to complete the entire development under each of the alternative proposals.

2. The Avg. Annual Construction Jobs is calculated by taking the total construction man years and dividing by the number of years required to complete the development.

   For the 5 and 6 Million Alternatives, the time period for completing the entire project was 9 years. For the 3 and 4 Million Alternatives the time period was 6½ years, and for the 2 MIllion Alternative 2½ years.

3. & 4. Total Construction Payroll and Avg. Annual Payroll were based on Avg. Annual Wage for construction workers of $14,000.

Public Development:

1. Construction jobs generated by the Public Development was based on the assumption that 50% of the Construction Cost (See Table III) for the public improvements would be for construction wages. Based on an Avg. Annual Wage of $14,000 per worker, total construction man years were estimated.

2. Avg. Annual Construction jobs for the public development was based on a construction time period of 3½ years to complete the public improvements.

3. & 4. Construction Payroll and Avg. Annual Payroll were computed at $14,000/year/worker.

5. The Multiplier Effect on the local and regional economy was calculated by applying a multiplier of 2.5 to the Annual disposable income from construction payroll.

6. Tax Revenues:

A State personal income tax of 5% was applied to total Annual Construction Payroll.

It was assumed the State would return 11% of the personal income tax collected back to the City.

APPENDIX
for
Table III

Sources and Methods:

Direct Cost for Public Improvements:

Cost for public improvements are based on the BRA Engineering Department Report, updated June, 1975.

1. Land Acquisition Cost:

   Acquisition Cost for public improvements reflects estimated land assembly cost for New Charles Street.

   Total cost for Land Acquisition was estimated at $3,666,775. However, under the 4, 5, and 6 Million Alternatives, the City would receive $1,498,065 from the disposition of the Park Square and Elliot Street Parcels. Thus, the net cost for the City of Land Acquisition under these Alternatives was $2,168,710.

2. Relocation Cost:

   Relocation costs are based on the BRA's Relocation Plan for Park Plaza, June 1975.

   The relocation costs from the June 1973 report were increased by 20% to reflect inflationary trends.

   The relocation costs for the public improvements represent the total estimated cost for relocating business and residents of Parcel 5.

3. Demolition and Site Preparation:

   Based on BRA Engineering Department estimates, June 1975.

4. Construction/Improvements Costs:

   Construction costs for the New Charles Street and other public improvements (as outlined in Table IV) are based on the BRA Engineering Department, updated report, June 1975.

   Included in the construction cost, however, is an additional $840,000 for the mitigation of the Public Garden Combined Sewer Surcharge.

Only 30% of the total cost of $2.8 million (as estimated in C. T. Maine Report, 1975) was allocated to each of the Park Plaza development alternatives, since the problem of combined sewerage overflow is an existing problem.

Although the problem of the overflow may be exacerbated by the new development (particularly the 5 and 6 Million Alternatives), it is not a direct result of new development on the Park Plaza site.

The 30% allocation figure was based on the Park Plaza Area's estimated share of sewerage discharge into the System.

5. Legal and Engineering Fees:

   Where estimated at 16% for engineering and 15% for legal and lther fees based on total construction costs.

6. Contingencies and Inflation:

   A 15% factor was added for contingencies an inflationary factor of 13.4% was applied to construction cost for New Charles Street and a 33.6% factor for all other improvements.

7. Debt Servicing Cost:

   As part of the total Direct Cost for the public improvements, the total interest cost on the Bonds issued for the public improvements was added to the direct cost for improvements.

   It was assumed that the City would issue 20 year Bonds at 6.5% to finance the construction of New Charles Street and the other public capital expenditures.

Indirect Cost:

In addition to the direct cost to the City for the public capital improvements made in the Park Plaza Area, there would be indirect cost associated with the construction phase of the project. These indirect costs include loss of property tax revenues as the existing buildings on the Parcels are demolished and removed from the tax rolls as the new development proceeds.

It was assumed that the developer would pay the existing taxes on the land and buildings be acquired until demolition of the building. From the time the building is demolished to the completion of the new building, the developer

would pay property taxes based on the assessed value of the the land only at the time of acquisition.

Property tax loss during the development phase was estimated on a Parcel by Parcel basis and based on the current acquisition - Demolition - construction schedules for each of the alternatives.

A summary of the 1974 assessed value for Land and Buildings for each parcel appears in Table III - A.

Total assessed values were reduced by 15% for the Parcels to reflect tax exemptions and abatements.

The adjusted assessed value for only the buildings on each parcel was applied to the time required from Demolition to completion of construction by stage for each of development alternative. The total 1974 assessed value (adjusted) of the buildings (x) number of years site empty or under construction (x) $196.70/$1000 equals the total tax revenue loss for the parcel during construction phase.

It was assumed that property taxes in the first year on the value of the completed structure, even through not fully occupied, would at least equal the taxes on the current building.

Job Dislocation:

Another indirect cost to the City during the development period would be the dislocation of the existing jobs on the site.

Employment was determined for each parcel and the total job dislocation was estimated by alternative.

It was assumed that approximately 70% of the workers would relocate to somewhere else in Boston. Thus, there would be a net loss to the City of only 30% of the total job dislocation. This 30% was based on historical experience of BRA Business Relocation Department which estimates that 10 to 15% of the firms would go out of business and another 10 - 15% would relocate to outside the City.

See attached Table III (B) for list of business and employment by Parcel.

Table III (A)

1974 ASSESSED VALUE OF PROPERTIES IN PARK PLAZA SITE

Summarized by Parcel and Development Alternative

		1974 Assessment		
	Parcel #	Land	Buildings	Total
3 Million Alternative	Parcel 4	$1,769,200	$ 190,800	$1,960,000
	Parcel 5	943,200	330,500	1,273,700
	Parcel 6	943,000	682,000	1,625,000
	Parcel 9	201,500	143,500	345,000
	Parcel 10	647,500	486,100	1,133,600
	Total 3 Million Alternative:	$4,504,400	$1,832,900	$6,337,300
4 Million Alternative	Parcels 7 & 8	$ 553,500	$ 258,900	$ 812,400
	Total 4 Million Alternative: (plus 3 Million Alternative)	$5,057,900	$2,091,800	$7,149,700
5 Million Alternative	Parcels 1 & 2	$1,252,600	$ 823,400	$2,076,000
	Total 5 Million Alternative: (plus 4 Million Alternative)	$6,310,500	$2,915,200	$9,225,700
6 Million Alternative	Parcel 11	$ 518,500	$ 154,500	$ 673,000
	Total 6 Million Alternative: (plus 5 Million Alternative)	$6,829,000	$3,069,700	$9,898,700

PARK PLAZA RELOCATION IMPACTS

Major Business Concerns and Organizations to be Relocated

..chin: 3 million alternative land area.

Name of Business	Type of Business (No. of Employees)
Parcel 4	
Graphic Design for Adv.	Advertising Artist (1)
Haughey Art Studio	Commercial Artist (1)
Philip B. Herr & Assoc.	Planning Consultant (5)
I S D, Inc.	Interior Design (6)
Italian-Amer. Charitable Soc.	Charitable Org. (1)
Kenneth Kimball	Advertising Artist (1)
Langone Monogram Studio	Monogram Stitcher (2)
Martucci Studio	Advert. Art Studio (4)
Mitsy	Seamstress (1)
Alfred Moraski	Commercial Artist (1)
Motor Carriers Inc. Agency	Insurance Agency (11)
A. W. Nickas	Commercial Artist (1)
J. Rudolph Schonberg	Furrier (1 - 3)
Barbara Crowley	Commercial Artist (1)
Stacy Advertising Art	Commercial Artist (1)
J. D. Stefano	Architect (1)
Unempl. Comp. Advisory Corp.	Management Consultants (15)
niel Ranney	Christian Science Prac. (1)
ohn Gilbert Co.	Liquor Store (6)
Card Carosel	Card Shop (1)
Mouse Trap Cabaret	
Playboy Club of Boston	
Avis Rent-A-Car	Car Rental (20)
Teddy Bear Lounge	Night Club (20)
Park Sq. New York Deli	Delicatessen (12)
Park Sq. Pub, Inc.	Cafe
Meyer Bros. Auto Park	
Boston Gas Co.	Office and Sales (3)
The Paul Revere Printers	Printers
George Kalofiatis	Commercial Artist
Rich T. LaRoche	Commercial Artist
Joseph P. Durkin	Commercial Artist
Ad East Enterprises, Inc.	Trade Paper
Louis A. Ackerman	Commercial Artist
Bene-Frost Assoc., Inc.	Design Engineers
Stanley R. Swanson	
Boston Society of Civil Enrs.	
AAACon Auto Transp. Inc.	Auto Transport Co. (3)
American Industrial Dvlpmt.	Org. of Professionals (8)
Astra Enterprises	Talent Agency (1)
Boston News, Inc.	Publishing (2)
Arthur Choo Assoc.	Engineering Consultant (7)
drew Christo	Engineers (9)
onsult. Engr. Council of N.E.	Professional Assoc. (1)
D B & B	Advertising (8)
D. Herbert Dye	Commercial Artist (2)
J. H. Gould & Sons	Violin Dealer (1)

Name of Business	Type of Business (No. of Employees)
Parcel 5	
Biltmore Green Luggage	Retail Luggage (3)
Liquor Store	Liquors
Adams & Abbott, Inc.	Photo Reproductions (14)
Ben Black Studio	Commercial Artist
Joseph Patti Studio	Art Studio
Lawyer's Com. for Civil Rights	Practice of Law (7)
Data Services	Data Processing (16)
Jimbaldwin Graphics	Graphic Designs (1)
George Kelley Assoc.	Graphic Designs (1)
Modern Hair & Scalp Spec.	Hair Treatments (1)
Alfred J. Philip	Engrosser (1)
Klein, Kurlan, Barr & Ross	Advertising Agency (8 - 10)
Mass. Law Reform Institute	Nonprofit Corp. (22)
M. Hyde Dental Laboratory	Dental Laboratory (1)
Harper Method Hairdressing	Hairdressing (1)
Yale Rachlin	Artist
New Eng. Coloring Service	Photographic Coloring (1)
City of Boston Cab Assoc.	
Robert Viano	
Martin Bloom	Architect
John F. Markham	Attorney
Bob O'Shaughnessy	Photographer
Merril A. Bent	Illustrator (1)
Karl H. Becker	Cert. Public Acct.
Edwin D. Abrams, Inc.	Real Estate (3)
Park Sq. Realty Trust	Real Estate -
Eunice Viles	Public Stenographer
Peretti Co. - Tobacco	Smoke Shop - tobacco (5)
White Tower	Lunch Counter (2)
Jack's Smoke Shop	Joke Shop (3)
Suffolk-Franklin Bank	Branch Bank (4)
Seamen's Friends Society	
Bus Terminal Restaurant	Restaurant (25 - 30)
Trailways of New Eng., Inc.	Bus Transp. Co. (150)
Almeida Bus Lines	
Boston Worcester Bus Line	
Peter Pan Co.	
Trailway Travel Bureau	
Parcel 6	
Eastern Gas Motor Mart Off.	Office
Ye English Tudor	
Sullivan's Cafe	
Pilgrim Car Wash, Inc.	Car Wash (8)
Mark the Tailor	Tailor Shop (1)
Boston House of Pizza	Pizza
Andrews Liquor Store	
Hertz Corp.	Car Rental (9)
Benihana of Tokyo Rest.	Unable to obtain inf.
Bank Vault Serv. & Lock Co.	Sales and Installation (7)
Motor Mart Cigar Stand	Cigar Stand
University Coffee Shop	Unable to obtain information
Boston Photocopy	Graphic Reproductions (10)
Donnelly Advertising Co.	Signs -
Sarni Cleaners	Dry cleaning-retail (6)
Mobile Media, Inc.	
United Nations Association	

Name of Business	Type of Business (No. of Employees)
Parcel 10	
Low-cost Car Rental	
Gas Station (ARCO)	
Herbie's Ramrod Room	Club Restaurant (5)
Houndstooth	
Econo-Car	Car Rental (9)
Metropolitan Motors	Auto Repairs (2)
System Auto Pkg., Inc.	Parking Garage (9)
Cowardly Lion	Night Club (7-day lic.) (26)
Ace Recording Studios, Inc.	Recording Studios (10 - 15)
The Tavern Club	
Within: 4 million alternative (all of 3 million alternative, plus)	
Parcels 7 and 8	
Beacon Musical Instr. Co.	Musical instruments (12)
Carl Fischer Inc., of Boston	Retail music & instrs. (26)
Bartavian, Inc.	Antiques - Jewelery
Alexandrova Sascha	
ernard Weinstock, Inc.	Photo Retouching
M. Steinert & Sons	Retail Sales (30)
John Carney	Commercial Artist (1)
Gustave Roubound	Commercial Artist (1)
Preston Sandiford	Teacher (Music) (1)
Clara Shear	Voice Teacher (2)
Mayer Goldman	Adv. Artist (1)
Gertrude Tingley	Retail Music Furn.
Reginald Boardman	Voice
Simons On The Common	Restaurant
Design Hair Replacement	Hair Repl. Center
L. P. Morton Dental Lab.	Dental Laboratory (30 - 40)
Alpha Employment Agency	Placement Service (7)
Starr Costume Co.	Costumes (5)
Timothy Candles	
M. Goody & J. Clancy & Assoc.	Architects (16)
Conn Organ Studios	Retail (6)
Strahl Dental Lab.	Dental Laboratory (3)
Bay View Dental Lab.	Dental Laboratory (1)
Jewish Theol. Seminary	Seminary for Rabbis (2)
Beacon Dental Labs., Inc.	Dental Laboratory
David B. McClosky	Voice Tchr. & Therapist (1)
Epilepsy Soc. of Mass., Inc.	(5)
James Fair	Physical Therapist
Al-Anon Intergroup Council	Family Agency (1)
al. Transit Union #318	Union Office (1)
Oriental Tea Room	Reader (Tea Cups)
Big L Discount Store	Retail (4)

Name of Business	Type of Business (No. of Employees)
Broadcast New Service	
Irish Travel Bureau	
Mansfield Beauty Academy	Hairdresser's School (14)
John Garabedian	Accountant (3)
The Roux Co.	Classroom-Hair Color'g (4)
Polynesian Island	Restaurant
Lane's Furniture Co., Inc.	Retail Furniture (7)
Parcel 9	
Gary Theatre	Theatre
Union Oyster House	

Within: 5 million alternative

(all of 4 million alternative, plus)

Parcels 1 and 2	
Bachelors III	Restaurant & Lounge (35)
Arangio Barber Shop	Barber Shop (1)
Theo & Sons & Bostonian Shoe	Retail and Repair (Shoes) (1)
ker Shannon Co., Inc.	Bottled Liquor (2 - 4)
Gatsby's Restaurant	Restaurant
Academy Film Distributors	Film Distribution (4)
Holt Assoc., Inc.	Writer-Consult-Lecturer (6)
Ernest C. Jacoby Co., Inc.	Manufacturer's Rep. (5)
Advance Marketing & Adv.	Marketing & Advertising (5 - 6)
Garber, Garber & Garber	Attorneys (4)
Sperber Assoc., Inc.	Public Relations (7)
Esquire Theatres of Amer.	Film Distribution (4)
Martini Carl, Inc.	Men's Clothing (25)
Morgan Memorial	Antique Boutique (6)
Henry Frost Assoc.	Architectural Firm (4)
Careful Cleaning	Storage
Noonan Advertising, Inc.	Advertising Agency (3 - 4)
Henry Harding Menzies AIA	Architect
B. W. Baird & M. M. Baird	Real Estate Investment (2)
Hoyle, Doran & Berry	Architectural Firm (40)
H. Murray	Monuments
Evans Monuments	Monuments
R. M. Bradley & Co., Inc.	Real Estate Management (60)
Transp. Consultants Intern.	Travel Business (5)
Boston National Corp.	Real Estate
Storer, Damon & Lund	Insurance
Hawaiian Air Lines	
Norma Boutique	Retail
Whitney-Atwood-Norcross Assoc.	Architectural Firm (8)
Women's Edu. & Indus. Union	Retail & Social (62)
McDonald's	Cafeteria (14)

300

Name of Business	Type of Business (No. of Employees)
Leeds, Inc.	Retail Women's Clothes (80)
lause Gellotte, Inc.	Camera Store (12)
The Seventh Inn	Organic Food Restaurant
Mass. Rehabilitation	Office .
Walker's Riding Apparel	Riding Apparel (7 - 9)
Achorn Stationery Shop	Cards & Gifts (3)
O. J. Piehler - Furs	Retail-Storage-Tailor (3)
Stern-French, Advertising	Advertising Agency (8)
Studio	5 Commercial Artists
John Robert Powers School	Finishing School (15)
Robie Enterprises	Real Estate Management (9)
National Lease-All Corp.	Robie Enterprise
Robie Adv. Management Corp.	Robie Enterprise
Robie Secretarial School	Robie Enterprise
R.S.R. Realty Co., Inc.	Robie Enterprise
Boston Storage Warehouse Co.	Robie Enterprise
Mass. Rehabilitation	(20)

Within: 6 million alternative
(all of 5 million alternative, plus Parcel 11)

The Attic Lounge	
Carl Weitz	Meats
Helene Costume Co.	
Boston House of Pizza	Restaurant & Delic.
iving Room Lounge	
23 Lounge Bar	
Saxon Theatre	
Champagne Lounge	
Four Corners Lounge, Inc.	
Books & Gift Shop	Gift Shop

APPENDIX
for
Table V

Direct Economic Impact of New Development:

The economic impacts, in terms of sales, employment, payroll and tax revenues, were calculated for each of the alternatives based on the estimated economic impacts generated by each of the component uses (i.e. retail, hotel, office, residential and parking).

A breakdown of tax revenues and the other economic impacts generated by the components under each of the alternatives appears in Table V (A).

1. Average Annual Sales:

   Include estimated sales of the retail establishments, the hotel and parking facilities.

   Total Retail Sales were calculated on the basis of $130/s.f. for new retail space, $90/s.f. for the retained retail space and $135/s.f. for restaurant space.

   Hotel sales were based on average room rate of $42.00 and an annual occupancy rate of 75%.

   Beverage and food sales for the hotel were calculated at 80% of room sales.

   Parking garage revenues were estimated at 1200/space/year and assumes an 80% occupancy rate.

2. Average Annual Employment:

   Retail: Average Annual Employment for retail space was based on an average of $31,000 of sales/worker/year for new retail space and $26,000/worker for retention space.

   Office: Annual employment for office space was estimated at 200 s.f./worker for new office space and 180 s.f./worker for the retention space. These coefficients were applied to the estimated occupied office space. Occupied office space was based on an 87% efficiency factor and an occupancy rated 95% for new space and 85% efficiency and 90% occupancy rate for retention space.

   Hotel: Annual employment for the hotel was estimated at 837 s.f./worker.

Parking: Employment for parking facilities was based on an average of 1 worker per 200 spaces.

3. Average Annual Payroll:

Retail: Payroll for retail workers was based on average annual wage of $8000/worker for new retail space and $7500/worker for the existing space.

Office: Annual payroll for office employers was based on an average annual wage of $13,000/worker.

Hotel: Annual payroll was based on an average of $7500/worker.

Parking: Annual payroll was based on average annual salary of $9500/worker.

4. Tax Revenues:

State Tax Revenues: Total Annual State Tax Revenues include revenues from the sales, meals, room occupancy, business excise, and personal income taxes.

Sales Tax: Was calculated at 3% of retail sales.

Meals Tax: 8% of the estimated restaurant expenditures.

om Occupancy Tax: 5.7% of room sales.

Personal Income Tax: 5% of Annual Payroll for employees at Park Plaza. In addition, the average annual income for residents of Park Plaza was estimated at $18,500/capita for luxury apartment dwellers and $5500/capita for elderly residents. A 5% income tax was applied to total income for luxury apartment residents and a 3% effective tax rate was applied to the total income of elderly residents.

Business Excise Tax: For Retail, Hotel and Parking, the Business Excise Tax was based on the assumption that 8% of gross business revenues represent taxable net income which is subject to an average effective tax rate of 8%.

For office establishments and other professional and technical service establishments it was assumed that total annual employer compensation represented, on the average, 30% of the total annual output or gross revenues generated by the firm located in the Park Plaza office space. It was assumed that 8% of these gross revenues represent net taxable income which is subject to an effective tax rate of 8%.

City Tax Revenues: Total Annual City Tax Revenues include revenues from the property taxes and an estimated share of the State's sales, meals, room occupancy, business excise and personal income taxes that would be returned to the City.

5. Property Taxes:

Retail Space: Property Tax revenues from retail space were based on 25% of the "adjusted" gross rental income from retail space. Adjusted gross rental income for new retail space was estimated at $10.80/s.f. and for retention space at $5.00/s.f.

Office Space: Property taxes for office space were based on 23% of the "adjusted" gross rental income. For new office space adjusted gross rental income was calculated at $11.40/s.f. and for retention space at $6.00/s.f.

Hotel Space: Property taxes for the hotel were calculated at $500/room.

Residential Space: Property taxes from the residential development were calculated at 20% of the adjusted gross rental income. For the luxury apartments adjusted gross rental income averaged $6,800/unit/year. For elderly housing it was assumed that adjusted gross rental income would be approximately $1,270/unit/year.

Parking: Property taxes from the parking facilities were calculated at 20% of adjusted annual parking revenues. Parking revenues were based on $1200/space with an 80% occupancy rate.

6. Other Tax Revenues to City"

Sales Tax: It was assumed that the City would receive back from the State 15% of the sales tax.

For: Meals tax, room occupancy tax, business excise tax and personal income tax, it was assumed that the City would receive back 11% of the tax collected by the State.

It should be noted that because of the allocation of a share of the State's sales, meals, room occupancy, business excise and personal income taxes to the City, the total annual tax revenue figures for the State and City are not additive.

To get the total annual tax revenue generated by each alternative development for the City and the State combined - State taxes should be added to the City's property tax revenues.

APPENDIX
for
Table VIII

Direct and Indirect Public Cost

The basic source for public cost was the report done by the Boston Municipal Research Bureau and Abt. Assoc. on the Effects of High Density Development on Municipal Finances in the City of Boston, in April, 1974.

The report analizes the cost of various public services for a selected number of commercial and residential areas in the City. The data from this analysis and unpublished back-up material enabled us to develop a set of public cost coefficients for the various commercial land uses.

Since the cost coefficients for public services derived from the study were based on the City's 1972-1973 budget figures, we increased the Cost Coefficients by a per annum growth factor, (based on the ten year Avg. annual growth rates for the specific public cost), to reflect the estimated cost for these services in 1985.

For specific sources and methodology used to derive the original public cost figures, see the report.

For retail and office uses, public service costs were estimated on a per 1000/s.f. of space basis. For hotel uses it was based on a per unit basis, and for residential development on a per capita basis.

1. Police Protection:

   Costs for Police Protection were estimated from the municipal research report of $221/1000 s.f. of retail space; $94/1000 s.f. of office space; $221/hotel unit and $66/capita for residential.

   Over the past ten years, police costs have escalated at approximately 3% per annum. The cost coefficients for each of the uses were adjusted accordingly.

   The adjusted cost coefficients for police costs were: $321/1000 s.f. of retail space; $135/1000 s.f. of office space; $320.hotel unit; and $96/capitl for residential.

2. Fire Protection:

   The "Adjusted" 1985 cost for Fire Protection was estimated at $150/ 1000 s.f. for retail space; $115/1000 s.f. of office space; $150/hotel unit; and $105/capita for residential.

3, 4, 5, & 7. Public Service Costs for Public Works; Traffic and Parking; MBTA Deficit and County Court were developed in a similar manner and the cost coefficients were applied to the appropriate useage and density.

6. & 10. Public Service Costs for Parks and Recreation and Community-Wide City Services were developed based on the share of the City's total assessed property value represented by the land uses in Park Plaza.

For each of the land uses in each of the alternatives, we estimated the assessed property value. This assessed value was placed over the total assessed property value for the City, estimated at $3.6 Billion.

The property values for each of the components were based on the development cost, in the case of new development, and on replacement value for the (old) retention space. Under current assessing practices, the Assessment/Market value ratio is: 0.19 for new office space; 0.24 for other commercial space and 0.29 for residential property. These assessment/market value ratios were applied to development costs or estimated replacement values for each of the components to derive assessed property value.

The assessed property value ratios, (i.e. assessed value of component (e.g. retail space)/total assessed property value for the City ($3.6 Billion)), for each of the development components in each alternative were applied to the estimated 1985 cost for Community-Wide Services.

In the 1972-73 city budget, Community-Wide City Services Costs (taking out Parks and Recreation) were $63.1 million for commercial areas and $73.0 million for residential areas. These figures were increased by a factor of 2% per annum to estimate the 1985 cost for Community-Wide Services. The adjusted Community-Wide Services Costs (minus Parks and Recreation) were $82.5 million for commercial areas and $95.0 million for residential areas.

Because of the close proximity of Park Plaza to Public Gardens and Commons, it was assumed that useage of these facilities would be more intensive than for the average development. Therefore Parks and Recreation Costs were separated out of the Community-Wide Services, and the

cost for these services, for the Park Plaza users, was calculated at twice the average cost factor.

The cost for Parks and Recreation in the 1972-73 city budget was $7.7 million. To estimate the 1985 cost for Parks and Recreation, a 3% per annum growth rate was applied to the 1972-73 figure; bringing the cost for these services to $10.5 million.

To estimate the cost for Parks and Recreation for Park Plaza users, the assessed property value ratio for each of the commercial component users was increased by a factor of 2 and applied to the $10.5 million budget estimate. For the residential users, the average (city-wide) per capita cost for Parks and Recreation, adjusted to 1985 figures, was doubled.

8. Education:

The cost for education was based on the number of projected school age children for each of the residential development alternatives.

School-age population was estimated on the basis of Population Age profiles developed from surveys of the residents in downtown highrise apartment complexes (Prudential Center and Charles River Park). These surveys indicate that approximately 3% of the residents in the Park Plaza residential apartments would be school-age children. Because of the high incomes of the luxury apartment residents, it was assumed that 50% of the school-age children would attend private schools.

1985 Educational costs for residents of Park Plaza were estimated at $1500 per public school student.

See attached Table VIII (A) for detail breakdown of specific services included in each of the public services catagories above.

Table VIII(A)

CITY AND COUNTY COSTS INCLUDED IN THIS ANALYSIS

BY COST CATEGORY

I. DIRECT SERVICES -- CITY	1972-73 BUDGET
A. Police Department	
Prevention, control and reduction of crime	$41,572,080
Services to the community	4,430,951
Administrative	2,477,789
Police debt service*	15,825
Pension Benefits, Total*	5,800,000
Total Police Direct Services	$54,296,645
B. Fire Department	
To extinguish fires, protect lives and property against fire	$29,648,279
Administrative and general services	538,986
Enforcement of fire prevention laws and issuance of related permits and licenses	1,331,643
Community relations	98,601
Pension Benefits, Total*	5,400,000
Fire debt service*	131,157
Total Fire Direct Services	$37,148,666

Source: Boston Municipal Research Bureau and Abt Assoc. The Effect of High Density Development on Municipal Finances in the City of Boston, April 1974.

* All asterisked items are not included in the 1973-1974 Boston Program Budget.

C. Public Works Department

Snow	$ 2,794,000
Street cleaning**	4,213,300
Roadway patching	1,040,306
Sidewalk repair	121,000
Lighting	5,708,645
Refuse collection	9,121,700
Debt service*	6,437,222
Total Public Works Direct Services	$29,436,173

D. Traffic and Parking Department

I.	Administration, support and direction	$ 326,952
II.	Traffic movement and control	1,046,264
III.	Traffic regulation and enforcement	1,093,918
IV.	Transportation systems design	401,290
V.	Public safety	38,124
VI.	Traffic and Parking debt service	38,380
	Total	$ 2,944,928

E. MBTA Deficit

Local service	$18,785,314
Express Service	10,989,350
Total	$29,774,664

** Street cleaning data was not available for 1972; this entry consists of 1973 appropriations, and, consequently, slightly overestimates 1972 appropriations.

F. School Committee

Elementary schools*	$49,239,925
All other schools*	56,572,930
Debt service*	6,929,120
Extraordinary repairs debt service*	1,494,550
Pension benefits* (less teacher's pensions reimbursed by State)	3,407,403
Total	$117,643,928

G. Office of Public Service

Total	$1,404,948

H. Housing Inspection Department

Total	$1,747,513

Total Cost of Above Eight (8) Direct City Services	$274,397,465

II. COMMUNITY-WIDE SERVICES -- CITY

A. General Items

Health and Hospitals (deficit only)	$21,892,481
(Parks and Recreation Department)	(7,702,467)*
Library Department	7,121,446
Sewer Deficit*	4,021,830
Water Deficit*	3,210,646
Revenue Deficit*	3,400,000
State Assessment*	686,521
Execution of court, damage claims and reimbursements	1,811,000
Boston Redevelopment Authority	1,101,068
Building Department (deficit only)	1,682,059
Youth Activities Commission	615,205
Auditorium Commission	500,920
Mayor's Office of Cultural Affairs	463,400
Office of Human Rights	226,373
Licensing Board	166,055
Public Celebrations	131,300
Development and Industrial Commission	118,451
Civil Defense Activities	115,222
Air Pollution Commission	97,507
Mayor's Safe Streets Act Advisory Commission Staff	68,832
Conservation Commission	25,545
Entertainment of Guests	20,000
Freedom Trail Commission	15,000
Subtotal, General Items	$55,193,328

*For purposes of our Park Plaza Analysis, Parks and Recreation expenditures have been separated out of the total community-wide service budget.

B. Residential Items Only

Veterans Services Department	$9,148,694
Veterans Graves Registration	85,982
Transportation of school children	460,000
Commission on Affairs of Elderly	145,351
Consumer Affairs Council	23,164
Subtotal, Residential Items	$9,863,191

C. Debt Service Items (Principal and Interest)*

Construction of buildings, acquisition of land	$1,068,730
Departmental equipment	2,172,404
Hospital Department	93,600
Institutions Department (no longer separate department)	31,109
Library Department	59,152
Parks and Recreation Department	4,125
Acquiring land for public parks and playgrounds	53,595
Public Buildings Department (no longer separate department)	2,603
Remodeling, reconstruction or extraordinary repairs to public buildings	1,089,515
Public Welfare	8,876
Municipal Auditorium	321,649

312

Capital Improvements Loan	3,942,314
Hospital -- extraordinary repairs -- Act of 1963	154,780
Hospital Department -- extraordinary repairs -- Act of 1958 and 1963	594,325
Parking Facilities	1,381,610
Urban Redevelopment	4,639,791
Subtotal, Debt Service Items	$15,618,178
Total Cost of Community-Wide Services, City	$80,674,697

313

III. CENTRAL STAFF -- CITY

A. Pension Items -- 4% and 5% Plans*

Pensions, exclusive of county, school, police, and fire pensions	$12,934,393

B. General Items

Hospital and Insurance plan	$5,684,309
Public Facilities Department	5,594,391
Real Property Department	3,495,223
Administrative Services Department	2,588,052
Reserve Fund	1,975,000
Election Department	1,295,571
Assessing Department	1,291,185
Law Department	930,131
Auditing Department	604,370
Treasury Division, Treasury Department	482,616
Collecting Division, Treasury Department	456,436
Mayor's Office Expenses	470,702
City Council	431,105
City Council Proceedings	8,500
Workmen's Compensation	400,000
Workmen's Compensation Service	63,226
Registry Division, City Clerk Department	322,838
Boston Retirement Board	308,048
Weights and Measures Department	166,786
City Clerk Department	161,705
Finance Commission	109,767

U.S. Bond Allotment Plan	13,446
City Record	10,950
Office of Development	10,000
Zoning Commission	4,960
Board of Commissioner of Sinking Funds	2,665
Subtotal, General Items	$26,881,982
C. Debt Service Items (Principal and Interest, 1972)*	
Funding Loan -- Act of 1957	$ 2,740,125
New City Hall	1,662,800
Subtotal, Debt Service	$ 4,402,925
Total Central Staff Service Costs, City	$44,219,300
TOTAL CITY COSTS	$399,291,462

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BRA. Environmental impact report. Vol. II-The alternatives.

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